

# Rhodora

JOURNAL OF THE  
NEW ENGLAND BOTANICAL CLUB

---

Conducted and published for the Club, by

REED CLARK ROLLINS, Editor-in-Chief

ALBERT FREDERICK HILL

STUART KIMBALL HARRIS

RALPH CARLETON BEAN

RICHARD ALDEN HOWARD

CARROLL EMORY WOOD, JR.

} Associate Editors

---

Vol. 58

August, 1956

No. 692

CONTENTS:

- On the Identity of *Lesquerella angustifolia*.  
*Reed C. Rollins* ..... 199
- Some Michigan Records for *Sarracenia purpurea* forma hetero-  
phylla. *Frederick W. Case, Jr.* ..... 203
- A Cytotaxonomic Study of the Genus *Hymenopappus* (Com-  
positae). *Billie L. Turner* (continued from p. 186) .... 208

---

The New England Botanical Club, Inc.

8 and 10 West King St., Lancaster, Pa.

Botanical Museum, Oxford St., Cambridge 38, Mass.

**RHODORA**.—A monthly journal of botany, devoted primarily to the flora of the Gray's Manual Range and regions floristically related. Price, \$4.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) of not more than 24 pages and with 1 plate, 40 cents, numbers of more than 24 pages or with more than 1 plate mostly at higher prices (see 3rd cover-page). Back volumes can be supplied at \$4.00. Some single numbers from these volumes can be supplied only at advanced prices (see 3rd cover-page). Somewhat reduced rates for complete sets can be obtained on application to Dr. Hill. Notes and short scientific papers, relating directly or indirectly to the plants of North America, will be considered for publication to the extent that the limited space of the journal permits. Illustrations can be used only if the cost of engraver's blocks is met through the author or his institution. Forms may be closed five weeks in advance of publication. Extracted reprints, if ordered in advance, will be furnished at cost.

Address manuscripts and proofs to Reed C. Rollins,  
Gray Herbarium, 22 Divinity Ave., Cambridge 38, Mass.

Subscriptions (making *all remittances* payable to RHODORA) to  
Dr. A. F. Hill, 8 W. King St., Lancaster, Pa., or, preferably, Botanical  
Museum, Oxford St., Cambridge 38, Mass.

Entered as second-class matter March 9, 1929, at the post office at  
Lancaster, Pa., under the Act of March 3, 1879.

---

**INTELLIGENCER PRINTING COMPANY**  
*Specialists in Scientific and Technical Publications*  
EIGHT WEST KING ST., LANCASTER, PA.

---

**CARD-INDEX OF NEW GENERA, SPECIES AND  
VARIETIES OF AMERICAN PLANTS**

For all students of American Plants the Gray Herbarium Card-index of Botanical Names is indispensable. It is a work of reference essential to scientific libraries and academies and all centers of botanical activity. It includes genera and species from 1885 to date. The subdivisions of species from 1885 to date are now included and from 1753 to 1886 are in the process of being inserted. Issued quarterly, at \$25.50 per thousand cards.

GRAY HERBARIUM of Harvard University,  
Cambridge 38, Mass., U. S. A.

# Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 58

August, 1956

No. 692

## ON THE IDENTITY OF LESQUERELLA ANGUSTIFOLIA

REED C. ROLLINS

FERNALD's revision of Gray's Manual,<sup>1</sup> Gleason's revision of Britton and Brown's Illustrated Flora<sup>2</sup> and Palmer and Steyermark's Catalogue of the Plants of Missouri<sup>3</sup> include *Lesquerella angustifolia* on the basis of its presumed occurrence in the state of Missouri. In this, these authors undoubtedly followed Payson who, unfortunately, misapplied the name in his<sup>4</sup> monograph of *Lesquerella*.<sup>4</sup> He applied the name to a species occurring in southwestern Missouri and previously regarded as *L. gracilis*, but which is actually distinct from both *L. gracilis* and *L. angustifolia*. As a result of this confusion, Cory<sup>5</sup> was led to re-describe *L. angustifolia* as a new species under the name *L. longifolia*.

The original description of *L. angustifolia* in Torrey and Gray<sup>6</sup> and that of Watson<sup>7</sup> are definite enough and were obviously based on the original collection of Nuttall and a subsequent collection by Leavenworth, both obtained along the Red River more than a century ago. Evidently, the fact that *L. angustifolia* was not recollected in the interim between these early collections and the time Payson studied the group had something to do with his misinterpretation of the earlier work.

<sup>1</sup> Gray's Man. Bot. (ed. 8) p. 700. 1950.

<sup>2</sup> Ill. Fl. N. E. U. S. adj. Can. 2: 226. 1952.

<sup>3</sup> Ann. Mo. Bot. Gard. 22: 547. 1935.

<sup>4</sup> Ann. Mo. Bot. Gard. 8: 182. 1922.

<sup>5</sup> Field & Lab. 18: 96. 1950.

<sup>6</sup> Fl. N. Am. 1: 101. 1838.

<sup>7</sup> Proc. Am. Acad. 23: 253. 1888.

In order to be sure about the proper application of the name *L. angustifolia*, I have studied the type at the British Museum of Natural History. The type consists of two plants. The lowermost leaves are missing on both plants which are in the ripe fruiting stage. The cauline leaves are linear, thickish, and are covered with minute lepidote trichomes. The pedicels are rigid and divaricately ascending. There are two ovules per locule in the siliques. The type was compared in detail with a specimen of one of my collections (*Rollins 5583*) from the Red River Valley in Choctaw County, Oklahoma. The type and this specimen were found to be closely similar in every respect and unquestionably represent the same species. The type of *L. longifolia* Cory at the Herbarium of Southern Methodist University is also the same, and this name becomes a synonym of *L. angustifolia*.

*L. angustifolia* is not uncommon, usually on thin soil overlaying horizontally bedded limestone, in Choctaw County, Oklahoma. I saw and collected the species in a number of localities and it was frequently in the same location with *L. gracilis*, although the latter species was usually to be found on deeper soils. These two species are somewhat alike in habit, but they can be readily distinguished by the pubescence type and by the ovule number. The trichomes of *L. angustifolia* are disc-like from the fusion of the rays basally and appear as if they were a lepidote covering of peltate scales. At their densest, they make the leaves and stems silvery. The stems and leaves of *L. gracilis* are greener and have a sparser covering of small stellate trichomes with discrete branches. There are two ovules per locule in the ovary of *L. angustifolia*, whereas, in *L. gracilis*, there are from eight to twelve ovules per locule. Evidence of hybridization was not seen where these species were growing together even though I looked for it at several locations.

In addition to the Nuttall type and the Leavenworth collection, both from the Red River, but without any further specific locality data, the following collections of *L. angustifolia* have been studied; **Oklahoma**, CHOCTAW COUNTY: 6 mi. east of Hugo, April 13, 1955, *Rollins 5581* (GH); 6 mi. west of Fort Towson, *Rollins 5583* (GH); 5 mi. west of Fort Towson, *Rollins 5585* (GH); 2-3 mi. west of Fort Towson, May 24, 1953, *Moore & Iltis 405* (GH); 5 mi. east of Hugo, April 15, 1950, *Waterfall 9289* (GH); 9 mi. east of Hugo, *Waterfall 9290* (GH). MCCURTAIN COUNTY: 2 mi.

northwest of Idabel, April 19, 1954, *Waterfall 11820* (GH); near Idabel, May 20, 1916, *Houghton 3680* (GH). **Texas:** 1.5 mi. southeast of Clarks-ville, Red River County, May 12, 1949, *V. L. Cory 56031* (SMU, type of *L. longifolia*).

From the above data, it would appear that *L. angustifolia* is rather restricted in its range. It may be confined to a limited limestone area in southeastern Oklahoma and adjacent Texas. Such a restricted area of distribution would account, in part at least, for the long gap between the early collections and the recent ones. This species occurs in the same locality as *Leavenworthia aurea* which appears to be equally restricted in its distribution in southeastern Oklahoma and has had a similar history so far as paucity and infrequency of collections are concerned.

The Missouri species of *Lesquerella* mistakenly identified as *L. angustifolia* by Payson is unquestionably a distinct species. The next question is by what name should it be known? I have searched the literature and find no available name. Therefore, the species has to be described as new.

***Lesquerella filiformis* Rollins, sp. nov.**

Annual; stems numerous from the base, slender, branched, erect or the outer somewhat decumbent, densely covered with stellate trichomes, 1-2 dm. high, branches often filiform; basal rosette of leaves not formed; basal leaves few, entire, broadly spatulate to orbicular, rounded at apex, abruptly narrowed to a slender petiole, 1-2 cm. long including petiole, 5-8 mm. wide, stellate trichomes on both surfaces numerous but not overlapping; cauline leaves entire, densely pubescent, 1-3 cm. long, 1-6 mm. wide, lower cauline leaves petiolate, often with a broad blade, gradually becoming narrower and sessile upward; inflorescence not crowded; pedicels filiform, divaricately ascending, nearly straight, 7-10 mm. long, densely pubescent; sepals narrowly oblong, densely pubescent, 3-4 mm. long, ca. 1 mm. wide, outer pair slightly saccate; petals light yellow, spatulate, 7-9 mm. long, 2.5-3 mm. wide; filaments slender, dilated at base; anthers ca. 1 mm. long; siliques globose, glabrous both on the exterior and interior, nearly sessile, erect, 2.5-3 mm. in diameter; styles slender, 3-4 mm. long; stigma unexpanded; ovules 2 in each loculus; funiculi attached to thin septum toward base only; seeds brown, somewhat flattened, not margined.

*Herba annua; caulibus erectis ramosis tenuibus pubescentibus 1-2 dm. altis; foliis stellato-pubescentibus; foliis radicalibus petiolatis integris late spathulatis vel orbicularibus 1-2 cm. longis, 5-8 mm. latis; foliis caulinis inferne petiolatis superne sessilibus anguste spathulatis vel linearibus 1-3 cm. longis, 1-6 mm. latis; pedicellis filiformibus rectis divaricatis pubescentibus 7-10 mm. longis; sepalis anguste oblongis pubescentibus 3-4 mm.*

longis, ca. 1 mm. latis; petalis flavis spathulatis 7-9 mm. longis, 2.5-3 mm. latis; siliquis glabris globosis subsessilibus erectis 2.5-3 mm. diametro; stylis glabris 3-4 mm. longis; loculis 2-ovulatis; seminibus immarginatis.

Type in the Gray Herbarium collected on thin soil, limestone barrens, Turnback, Dade County, Missouri, May 5, 1929, *E. J. Palmer 35604*. An additional collection in the Gray Herbarium is *J. W. Blankenship s. n.* made at Willard, Greene County, Missouri, May 7, 1887.

The illustration and description in Payson's monograph (l.c.), so far as I can interpret them, apply completely to this species. The illustration shows the numerous stems, the branching habit and the lack of a basal rosette of leaves. As pointed out by Payson, the species is amply distinct from *L. gracilis* because of the subsessile siliques with 2-ovuled loculi and the filaments with dilated bases. Actually, *L. filiformis* is more closely related to *L. angustifolia* than it is to *L. gracilis*. However, it has stellae with distinct rays instead of stellae of disc-like peltate scales with basally fused rays as found in *L. angustifolia*. Otherwise, the plants of *L. filiformis* are much smaller in every respect than those of *L. angustifolia*. With respect to height, the upper limit of 2 dm. in *L. filiformis* is about the lower limit for *L. angustifolia*. The lower leaves of the latter are dentate to lyrate-pinnatifid, whereas, they are entire in *L. filiformis*. The two species are sufficiently distinctive in aspect to prevent confusion of identity.—GRAY HERBARIUM OF HARVARD UNIVERSITY.



SOME MICHIGAN RECORDS FOR *SARRACENIA*  
*PURPUREA* FORMA *HETEROPHYLLA*FREDERICK W. CASE, JR.<sup>1</sup>

IN 1822, Eaton described a plant from the region of Northampton, Mass. as a supposed new species, *Sarracenia heterophylla*, distinguished by elongate leaves and yellow flowers. Later investigations have shown that the plant is not morphologically different from *S. purpurea* except that it differs in the color of its leaves and flowers. The elongate type of leaf is merely a change caused by shade, similarly shaped leaves being found on shaded plants of the typical form. Consequently, recent authors have reduced the taxonomic status of the plant from species to subspecies, then variety, and finally, a form (Fernald, 1922, 1950, and Gleason, 1952). Bell in his recent cytotaxonomic study of the pitcher-plants (1949) follows the last treatment.<sup>2</sup> The purpose of the present paper is to present new data on the occurrence of this interesting plant in Michigan, the localities reported being a little over 600 miles west of the previously known localities, all of which are along the eastern seaboard. (See map, Fig. 1.)

*Sarracenia purpurea* forma *heterophylla*, as currently understood, is characterized by the complete absence of red coloring anywhere in the plant. The flower petals of living specimens are of a pale lemon-yellow to greenish-yellow color. The leaves, although dull green in shade grown specimens, are yellow-green to rich yellow in sunny situations. In dried material the colors may appear golden- or brown-yellow. If any red coloration is present at all, the plant cannot be regarded as forma *heterophylla*.

Until the presently described locations came to light, all authenticated records for *Sarracenia purpurea* f. *heterophylla* have been confined to the northeast coast of North America, and even here authentic records are extremely rare. Records do exist from the following localities, as reported by Bell (l. c.):

<sup>1</sup> I wish to thank Drs. C. Ritchie Bell, W. H. Wagner, Jr., and E. T. Wherry, for their suggestions. I am especially grateful to Drs. Bell and Wherry for visiting the areas with me on September 4, 1955.

<sup>2</sup> Bell (l. c.) suggests, however, that it is possible that forma *heterophylla* "may deserve higher taxonomic rank."

Northampton, Mass. (where it was collected by Eaton); Main Arm, Bonne Bay, Newfoundland (Fernald and Long); Exploits River and Badger Brook, Newfoundland (Robinson and Schrenk); Young's Lake, Belle Isle, Nova Scotia (Fernald, and also Bell); and Forked River, New Jersey (Britton). Schallert applied the name "*heterophylla*" to herbarium material from North Carolina, but Bell discounts his records, since most of his specimens show red veining, and therefore should be excluded from this taxon (Bell, 1949). It is likely that all of Schallert's identifications represent deep shade ecads of typical *S. purpurea*.

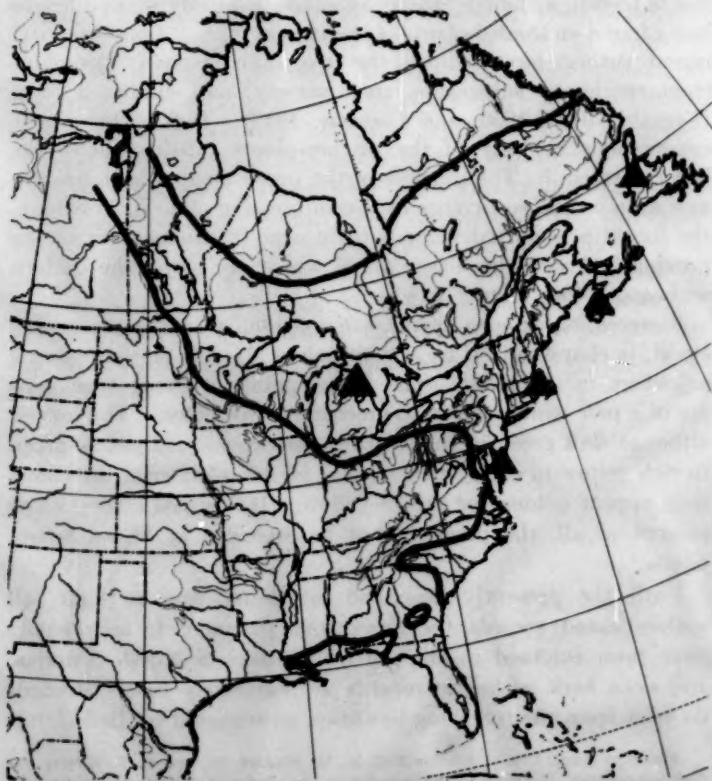


FIGURE 1. The distribution of *Sarracenia purpurea* in North America. The triangles represent authenticated localities for the forma *heterophylla*. General distribution adapted from E. T. Wherry, 1935.



In June, 1948, while botanizing in Montmorency County, Michigan, I came upon yellow-flowered plants of *Sarracenia purpurea* in a large spruce-tamarack bog, but at that time no record of the extent of distribution or of the number of yellow plants was made. Subsequent exploration revealed that forma *heterophylla* occurred in a number of bogs in this vicinity. When it became apparent that the numbers and distribution of the form in this area might possibly show some evolutionary pattern, a more extensive study was initiated. All of the bogs that the author could locate and to which he could gain access were explored during the years 1954 and 1955. This is not to imply, of course, that all suitable habitats in this bog-rich area have

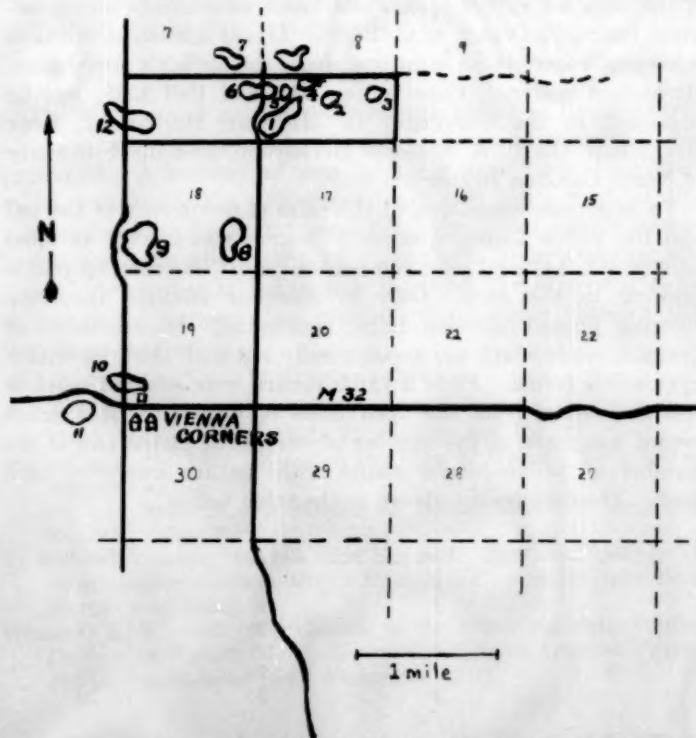


FIGURE 2. Portion of Township 30 N., Range 1 E., Montmorency County, Michigan, showing location of the explored bogs.

been covered; there are possibly others in which forma *heterophylla* will be discovered.

The locations of the explored bogs are shown on the accompanying map (Fig. 2). Forma *heterophylla* was found to occur in the bogs numbered 1, 2, 3, 8, and 9. A few of the plants found in bogs 6 and 7 appeared to be forma *heterophylla* but, as they were deeply shaded, final confirmation should be reserved until flowering specimens are seen. All the bogs are in Township 30 N., Range 1 E., Montmorency County, Michigan. Bogs 1, 2, 3, and 5 are in the south half of Section 8; bog 6 on the line between sections 7 and 8; bog 7 in the north half of Sect. 7; and bogs 8 and 9 are in Sect. 18 of the same township. All of the bogs are rather open *Picea-Larix* associations on Greenwood Peat soils (Veach et al. 1930). Living specimens of taxon *heterophylla* from these locations are in the author's greenhouse. Herbarium material, Case 900 to 908, and Bell 1548, will be deposited in the University of Michigan Herbarium, Gray Herbarium, the U. S. National Herbarium, and the University of North Carolina Herbarium.

To determine something of the ratio of occurrence of the red and the yellow forms, a series of counts was made. It must be stressed that any color comparisons must be taken on plants growing in the open. Only in complete sunlight does the coloring present develop fully, eliminating the confusion of greenish ecads which are genotypically red with the true anthocyanin-free forms. Plots 9 yards square were selected more or less at random from the open areas of bogs 1, 3, and 9. A record was made of the number of red-leaved plants and of the number of yellow-leaved plants with mature leaves in each plot. The findings are shown in the table below.

| Bog | Plot | Red form | Yellow form |
|-----|------|----------|-------------|
| 1   | 1    | 129      | 16          |
| —   | 2    | 77       | 21          |
| 3   | 1    | 29       | 37          |
| —   | 2    | 7        | 34          |
| 9   | 1    | 28       | 26          |
| —   | 2    | 25       | 20          |

The data are too few to be considered as a final indication of the rate of occurrence of the two forms in Montmorency Co.,

Michigan. Yet they show that in some of the bogs, at least, forma *heterophylla* is very well developed. Especially interesting is the observation that in each of bogs 1, 3, and 9 there is a considerable number of plants of an orange-red color which do not fit the concept of either the typical red or the yellow form. In the above counts, however, such plants were treated arbitrarily as red. These orange-red plants, not found in bogs unless the yellow form was present also, lead me to believe that forma *heterophylla* is not behaving as a simple Mendelian recessive, and that the possibility of genetic blending must be considered. In order to obtain more information on the genetic nature of forma *heterophylla* I have initiated various greenhouse breeding experiments which should provide some insight into the situation, and which will be duly reported upon.

#### SUMMARY

The history and nature of *Sarracenia purpurea* forma *heterophylla* is briefly reviewed and maps of its known occurrence are presented. A number of new localities have been discovered in Montmorency Co., Michigan, over 600 miles west of the nearest localities heretofore recorded. Results of sample counts in various bogs where the two color forms occur together are given. A number of individuals in which the dominant color is orange-red suggest that genetic intermediates between the two forms may exist.

#### LITERATURE CITED

- BELL, C. R. 1949. A Cytotaxonomic Study of the Sarraceniaceae of North America. Jour. Elisha Mitchell Sci. Soc. 65: 137-166.
- FERNALD, M. L. 1922. Notes on the Flora of Western Nova Scotia. RHODORA 4: 165-183.
- . 1950. Gray's Manual of Botany, 8th Ed. American Book Co. New York.
- VEACH, SCHOERMANN, MILLAR, and SHEARIN. 1930. Soil Survey of Montmorency County, Mich. U. S. Dept. of Agriculture Bull. No. 39 (series 1930).
- WHERRY, E. T. 1935. Distribution of the North American Pitcher Plants. In Walcott, M. V., Illustrations of North American Pitcher Plants. Smithsonian Inst., Washington, D. C.

A CYTOTAXONOMIC STUDY OF THE GENUS  
HYMENOPAPPUS (COMPOSITAE)

BILLIE L. TURNER

(Continued from page 186)

Following is a list of herbaria consulted during this study. The abbreviations used in citation of specimens are those recommended by Lanjouw and Stafleu (1952). Grateful acknowledgment is made to the curators concerned for the loan of material.

CAS California Academy of Sciences; DS Dudley Herbarium, Stanford University; GH Gray Herbarium of Harvard University; MO Missouri Botanical Garden; NY New York Botanical Garden; POM Herbarium of Pomona College; RM Rocky Mountain Herbarium, University of Wyoming; RSA Rancho Santa Ana Botanic Garden; SMU Southern Methodist University; TEX University of Texas; UC University of California, Berkeley; US United States National Herbarium, Smithsonian Institution; WS State College of Washington.

## TAXONOMY

**Hymenopappus** L'Hér. Hymenop. 1. 1788.

*Rothia* Lam., Jour. Hist. Nat. 1: 16. 1792, non *Rothia* Schreb.

Biennial and perennial, subscapose to leafy-stemmed herbs from a single unbranched, obconical tap-root (in biennial species) or from a woody, much-branched tap-root bearing several crowns (in perennials); stems slender to stout, erect, angled and sulcate, often pithy; leaves alternate, forming a basal rosette, mostly bipinnately dissected to rarely simple or merely lobed, reduced up the stem, minutely impressed-punctate, with usually inrolled margins; inflorescence a few- to many-headed cymose panicle; heads discoid or radiate, subturbinate to broadly campanulate, on slender conspicuous peduncles; involucre of 6-14 subequal bracts in 2-3 series, these membranous at the apex or rarely throughout; receptacle dome-shaped to nearly flat, without chaff, except in *H. newberryi*; ray florets, when present, pistillate and fertile, with conspicuous white ligules; disk florets with regular corollas (at least the throat), yellow to white or less often reddish-purple, narrowed below into a slender, mostly glandular tube, and above this (after anthesis) an abruptly flaring, campanulate to funnelform throat, lobes equal, ovate, reflexed after anthesis; style branches more or less strongly flattened with obtuse, papillose tips, stigmatic lines marginal on the upper surface; anthers partially to completely exserted, shortly cordate-sagittate at base with ovate terminal appendages; achenes with 4 faces, obpyramidal to rarely incurved and diagonally compressed, the narrow base often shortly stipitate (in biennial species), faces 0-3-nerved, glabrous to densely pubescent with ascending or spreading hairs; pappus when present of 12-22 linear-oblong or broadly

ovate, obtuse, hyaline scales, usually with an included medial nerve; chromosome number, so far as known, with a base of  $x = 17$ .

Type species: *Hymenopappus scabiosaeus* L'Hér.

#### KEY TO THE SPECIES OF *HYMENOPAPPUS*

1. Plants perennial, roots bearing several to many crowns; stem-leaves few, 0-10(-12); heads per stem few, 1-20 (-50); corolla throat 2-8 times as long as the lobes. . . . Series PERENNES.
  2. Heads with conspicuous white rays.
    3. Receptacle chaffy; pappus 0.1 mm. long or obsolete. . . 1. *H. neuberryi*.
    3. Receptacle naked; pappus 0.4-0.6 mm. long. . . . . 2. *H. radiatus*.
  2. Heads eradiate (or in extremely rare specimens of *H. filifolius* var. *cinereus* with poorly developed rays).
    4. Leaves bipinnately dissected with narrow, linear divisions; achenes densely pubescent. . . . . 3. *H. filifolius*.
    4. Leaves simple or once-pinnate with broad divisions; achenes glabrate. . . . . 4. *H. mexicanus*.
1. Plants biennial, roots bearing a single crown (rarely 2 through injury); stem-leaves many, 10-100 (rarely less); corolla throat 1-2(-3) times as long as the lobes. . . . . Series BIENNES.
  5. Heads with conspicuous white rays. . . . . 5. *H. biennis*.
  5. Heads eradiate.
    6. Achenes glabrous; pappus 0.2 mm. or less long. . 6. *H. flavomarginatus*.
    6. Achenes pubescent; pappus 0.2-2 mm. long.
      7. Corolla tube 1.5-2(-2.2) mm. long; basal rosette leaves bipinnately dissected, with mostly linear ultimate segments, 0.5-6 mm. wide; flowers yellow or white; corolla throat campanulate (very rarely funnelform).
        8. Flowers white; ultimate leaf segments narrowly linear, 0.5-1.5 mm. wide. . . . . 7. *H. tenuifolius*.
        8. Flowers yellow; ultimate leaf segments short, narrow to broad, 1-6 mm. wide.
          9. Leaf segments 2-6 mm. wide; leaves usually glabrous or less pubescent above; pappus 0.5-1(-1.2) mm. long. . . . . 8a. *H. flavescens* var. *flavescens*.
          9. Leaf segments 1-2 mm. wide; leaves usually evenly pubescent on both surfaces; pappus 1-1.5 mm. long (rarely less)
            - 8b. *H. flavescens* var. *cano-tomentosus*.
    7. Corolla tube 2-3 mm. long; basal rosette leaves simple to bipinnate with broad ultimate segments 5-20 mm. wide; flowers white or vinaceous, never yellow, corolla throat funnelform (rarely campanulate).
    10. Basal rosette leaves once-pinnate to bipinnately parted; flowers white; pappus 0.2-0.8(-1) mm. long; plants of clayey soils in grasslands of Texas, Oklahoma, Kansas, and Nebraska, or sandy soils of the Upper Mississippi Valley and S.E. United States.

11. Peduncles with conspicuous ovate, membranous, petaloid bracts 5-14 mm. long (rarely less); involucre bracts white-membranous for half their length or more, 7-15 mm. long  
9a. *H. scabiosaeus* var. *scabiosaeus*.
11. Peduncles ebracteate or with non-membranous, short, subulate scales; involucre bracts yellowish to white membranous for 2-4 mm. at the tip, 5-9 mm. long. . . 9b. *H. scabiosaeus* var. *corymbosus*.
10. Basal rosette leaves simple to once-pinnate; flowers vinaceous or reddish-tinged (rarely completely white); pappus 0.5-2 mm. long; plants in sandy soils of Louisiana and eastern and southern Texas.
12. Involucre bracts 6-12 mm. long, snowy-white membranous for half their length or more; pappus 0.5-1(-1.5) mm. long; stem-leaves (6-)8-16. . . . 10a. *H. artemisiaefolius* var. *artemisiaefolius*.
12. Involucre bracts 5-7 mm. long, membranous for 1-2 mm. at the tip; pappus 1.5-2 mm. long; stem-leaves 2-8. . . 10b. *H. artemisiaefolius* var. *riograndensis*.

#### SERIES PERENNES

##### 1. *Hymenopappus newberryi* (Gray) Johnston

*Leucampyx newberryi* Gray, in Porter and Coulter, Synopt. Flora Colorado, p. 77, 1874. *H. newberryi* Johnston, Contrib. Gray Herb. n.s. 68: 96. 1923. Type examined (GH): Colorado, "La Pajosa, July 29, 1860," McComb's Exped., *Dr. Newberry*. Isotypes (NY, US) give the locality as "La Pajosa" and the date as 1859.

Plants perennial, 20-60 cm. high, sparsely tomentose to nearly glabrate; rosette leaves 12-25 cm. long, 3-5 cm. wide, bipinnately dissected with narrow, linear, mostly flattened ultimate divisions, evenly and sparsely canescent on both surfaces to nearly glabrate, inconspicuously impressed-punctate; stem leaves 1-3(-5), much reduced; heads 3-8 per stem, broadly campanulate, 2-3 cm. in diameter, 60-150-flowered, on stout ultimate peduncles 6-15 cm. long; receptacle chaffy, dome-shaped, 5 mm. across, 3 mm. high; chaff deciduous, 5-9 mm. long, 2-5 mm. wide, partly to completely (near the periphery of heads) enclosing the achenes, minutely glandular to nearly glabrous, yellow-membranous, except near the base; principal involucre bracts 8-10 mm. long, 4-7 mm. wide, white or yellowish-white membranous for 2-4 mm. from the mostly obtuse tip; ray flowers 8, pistillate and fertile, tubular at the base for about 2 mm., with a conspicuous white (rarely pink) ligule, 14-20 mm. long, 8-15 mm. wide, 3-cleft at the apex, the sinus 2-3 mm. deep; disk flowers yellow, 3.5-4 mm. long, the tube sparsely glandular to nearly glabrate, 1.5-2 mm. long, throat campanulate 1.5-2 mm. long with lobes reflexed, 2-3 times longer than the lobes; style branches about 1 mm. long, short and flattened, with well defined stigmatic lines along the upper margins; achenes black, glabrous, narrowly obpyramidal, diagonally compressed



and strongly incurved, 3.5–4 mm. long; pappus minute (less than 0.1 mm. long) or absent; anthers not much exerted, 2.2–2.5 mm. long;  $n = 17$ .

DISTRIBUTION.—South-central Colorado and north-central New Mexico on clayey, principally igneous soils of mountainous regions, 7,000 to 10,000 ft., usually in open areas of pine, spruce or aspen woods (Fig. 24). June–September.

Gray described this species as being the sole member of a new genus *Leucampyx*, and placed it in the tribe Anthemideae of the Compositae. He recognized its resemblance to *Hymenopappus*, but apparently thought this a superficial one, assigning more significance to the technical characters of ray florets and chaff.

It was not until 1891, when Rose described the new species, *H. radiatus*, that this assignment of *Leucampyx* to the tribe Anthemideae was seriously questioned. The presence of an obviously rayed species of *Hymenopappus* no longer justified the tribal separation of *Leucampyx*, or even its maintenance as a separate genus. It remained for Johnston (1923) finally to reduce *Leucampyx* to generic synonymy under *Hymenopappus* and make the appropriate combination for the species. The work of the present author, both cytological and morphological, completely confirms this latter treatment.<sup>7</sup>

*Hymenopappus newberryi* has probably retained more primitive characters than any other member of the genus. Accordingly, from this species one may get an idea as to the main evolutionary trends that have occurred within the genus, foremost of which has been the progressive loss of parts such as chaff and rays. It seems probable that the *H. filifolius* complex had its origin from the *H. newberryi* line, or its immediate ancestor, at some early time. *H. radiatus* is thought to represent a more recently derived species which has differentiated directly from *H. newberryi*.

REPRESENTATIVE SPECIMENS.—**Colorado.** ARCHULETA CO.: Pagosa

<sup>7</sup> It appears likely that even the natural genetic barriers may rarely break down between *H. newberryi* and related species. John Beaman, of Harvard University, collected in 1954 several rather remarkable rayed specimens of what otherwise appeared to be *H. filifolius* var. *cinereus*. These collections were made 10.3 mi. east of Taos, New Mexico, and were taken from a population growing near that of typical *H. newberryi* (Beaman 726; GN, TEX). The plants in question have relatively short, poorly developed rays and are without chaff; however, the achenes and pappus are somewhat intermediate between the two taxa. If hybridization has been responsible for this variation, then its occurrence must be quite rare since similar variability was not detected in the numerous sheets examined from this area—nor was it detected in population studies during preliminary field work on the genus.

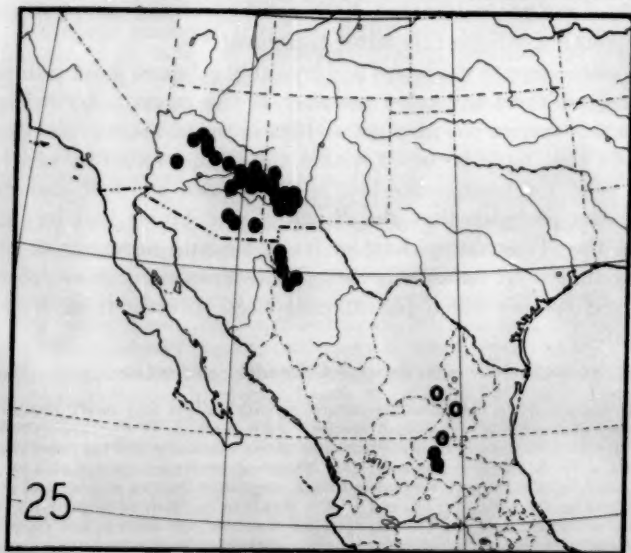
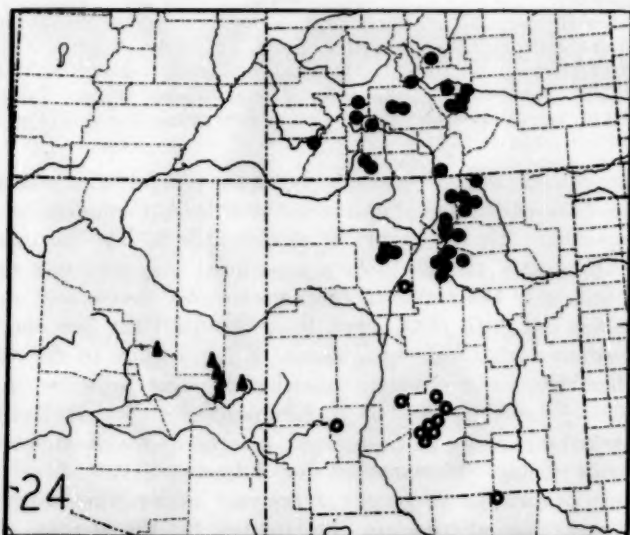


FIG. 24-25. Distribution of *Hymenopappus* species. Fig. 24. *H. radiatus* (triangles), *H. newberryi* (disks), and *H. biennis* (circles). Fig. 25. *H. mexicanus* (disks), and *H. flavomarginatus* (circles).

Springs, Bethel, Willey & Clokey 4371 (CAS, DS, MO, NY, RM, UC, US, WS). CHAFEE CO.: Salida, (w/o date), A. Lansing (MO, UC). COSTILLA CO.: West Indian Cr., Rydberg & Vreeland 5476 (NY, RM). CUSTER CO.: Hard-scrabble Canyon, Penland 1266 (CAS, US). DOLORES CO.: 5 mi. S. of Rico, Maguire & Piranian 12925 (GH, UC). FREMONT CO.: near Canon City, 1871, Brandegee 294 (MO, NY). GUNNISON CO.: 16 mi. E. of Lake City, Cebolla Cr., Rollins 1420 (MO, NY). HINSDALE CO.: Spring Creek Pass, Hitchcock, Rethke, & van Raadshooven 4101 (DS). MINERAL CO.: Rio Grande Nat'l. Forest, near Elliott Cr., June 18, 1911, J. Murdock, Jr. 4623 (GH, MO, NY, UC, US). PARK CO.: South Park, 1871, Brandegee 294 (MO, UC). SAGUACHE CO.: W. side of summit, Cochetopa Pass, Weber 5775 (SMU, WS). **New Mexico.** COLFAX CO.: near Vernejo, H. M. Hall R335 (UC). SANDOVAL CO.: La Cueva Springs, Preece & Turner 2745 (SMU, WS). SAN MIGUEL CO.: Pecos R. Nat'l. Forest, Winsor's Ranch, Standley 4003 (GH, MO, NY, RM, US). SANTA FE CO.: vicinity of Santa Fe, Lake Peak, Arsène & Benedict 16016 (US). TAOS CO.: 10 mi. E. of Taos, Rollins & Chambers 2415 (DS, GH, US).

## 2. *Hymenopappus radiatus* Rose

*Hymenopappus radiatus* Rose, Contrib. U. S. Nat. Herb. 1: 122. 1891. Type examined (US): "Willow Spring, Arizona," July (5-6), 1890, Dr. E. Palmer 615. According to Rose (1891), "Willow Springs is in the White Mountains near the pass leading to Ft. Apache."

Plants perennial, 30-45 cm. high, sparsely to densely tomentose; larger rosette leaves 8-14 cm. long, bipinnately dissected with linear, somewhat flattened, ultimate segments, 1-2 mm. wide; stem leaves 2-3, much reduced; heads 6-8 per stem, campanulate, 40-60-flowered, on ultimate peduncles 3-8 cm. long; principal involueral bracts 7-9 mm. long, 3-5 mm. wide, tomentose, yellow-membranous for 1-3 mm. from the acute to obtuse tip; receptacle dome-shaped, without chaff; ray flowers 8, tubular at the base for about 2 mm., extending into a conspicuous white ligule 14-16 mm. long, 5-10 mm. wide, usually with an emarginate or indistinctly 3-cleft apex; disk florets yellow, 3-4 mm. long, the tube 1.5-2 mm. long, sparsely glandular to nearly glabrous, the throat campanulate, 1.5 mm. long with lobes reflexed, 3 times longer than the acute lobes; achenes purplish-brown, 4-4.5 mm. long, obpyramidal and 4-sided, becoming diagonally compressed and incurved toward the periphery of the head; pappus of 14-18 small, obtuse scales, 0.4-0.6 mm. long; anthers partially exerted about 2.5 mm. long;  $n = 17$ .

DISTRIBUTION.—Endemic to Arizona; sandy tuffaceous or igneous soils on south-facing slopes in pine woods of east-central Arizona (Mogollon Rim and White Mountains), 7000-9000 ft. (Fig. 24). May-July.

*Hymenopappus radiatus* probably has its closest relative in *H. newberryi*. It differs from this latter species primarily by its non-chaffy receptacle, and less diagonally compressed, incurved achenes. The similarity of the two species is remarkable,

and for this reason it is believed that *H. radiatus* has been derived directly from or through *H. newberryi*, this derivation requiring only the loss of chaff from the receptacle.

REPRESENTATIVE SPECIMENS.—**Arizona.** APACHE CO.: Willow Springs, *E. Palmer 615* (GH, US). COCONINO CO.: Mogollon Mts., *Collom 204* (GH, MO, NY, US). NAVAJO CO.: Cooley's Ranch (semi-open flats), *Goodding 1106* (NY, RM, US); Holbrook to Showlow, *J. Goodwin 112* (CAS); Forestdale, 66 mi. S. of Holbrook, *W. Hough 69* (US); Fort Apache, 1893, *R. W. Hoyt* (NY); 9.5 mi. N. of White River, highway 73, *Preece & Turner 2686* (SMU, WS); Fort Apache, 1892, *E. A. Shuttlesworth* (US).

### 3. *Hymenopappus filifolius* Hook.

*Rothia filifolia* (Hook.) O. Ktze., Rev. Gen. 1: 361. 1891.

Plants perennial, supscapose to rarely leafy-stemmed, 5–100 cm. high, densely tomentose to nearly glabrate; rosette leaves 3–20 cm. long, bipinnately dissected with linear, flattened or nearly filiform ultimate divisions, 2–50 mm. long, minutely impressed-punctate; stem leaves 0–12, usually much reduced upward; heads 1–60 per stem, subturbinate to broadly campanulate, 10–80-flowered, on ultimate slender peduncles 0.5–16 cm. long; receptacle naked (very rarely with 6–10 well developed chaffy scales); principal involucre bracts 3–14 mm. long, 2–5 mm. wide, white or yellowish-membranous for 1–4 mm. from the acute to obtuse tip; corollas yellow or less often white, 2–7 mm. long, tube densely glandular to nearly glabrous, 1–2.5 mm. long, throat campanulate, 1–3 mm. long with lobes reflexed, 2–8 times longer than the lobes; achenes obpyramidal, 4-sided, 3–7 mm. long, densely pubescent with hairs 0.2–3 mm. long; pappus of 12–22 linear oblong scales, 0.1–3 mm. long; anthers partially exerted, 1.6–4 mm. long;  $n = 17, 34$ .

DISTRIBUTION.—Principally western United States in the Rocky Mts., Great Basin, Columbia Basin, northern Great Plains, and peripheral areas.

#### KEY TO THE VARIETIES OF *H. FILIFOLIUS*\*

1. Basal leaf axils without a dense tomentum, usually glabrous or sparsely tomentose; stem leaves 0 or 1(2); plants 5–30 (–45) cm. high.
  2. Ultimate peduncles 0.5–1.5 cm. long; corolla 2–3 mm. long; achenes 3–4 mm. long. . . . . 3a. var. *parvulus*.
  2. Ultimate peduncles 2–10 cm. long; corolla 3–5 mm. long, achenes 4–6 mm. long. . . . . 3b. var. *nudipes*.
1. Basal leaf axils with a dense conspicuous tomentum; stem leaves 0–12; plants 5–100 cm. high.
  3. Corollas 2–3 mm. long; florets 10–30 (avg. 20) per head; involucre bracts 3–7 mm. long; leaf tips of basal rosette 1–6 mm. long.

\* Table 1 lists most of the important contrasts and should be used as a supplement to this key, which lists only the more conspicuous differences.

4. Stem leaves 0-3; pappus 0.1-0.8 mm. long; plants 5-20 cm. high.....3c. var. *luteus*.
4. Stem leaves 4-9; pappus 0.5-1.5 mm. long; plants 20-35 cm. high.....3d. var. *pauciflorus*.
3. Corollas 3-7 mm. long; florets (15-)20-70 per head; involucre bracts (5-)6-14 mm. long; leaf tips of basal rosette 3-50 mm. long.
5. Anthers 3-4 mm. long; corolla (3.5-)4-7 mm. long; pappus (1.2-)1.5-3 mm. long; achenes 5-7 mm. long; corolla throat 3-8 times as long as the lobes.
6. Flowers white; peduncles 8-16 cm. long; stem leaves 2-7; achene hairs 0.5-1 mm. long.....3e. var. *eripodus*.
6. Flowers yellow or rarely white; peduncles 2-12 cm. long; stem leaves 0-6; achene hairs 1-2 mm. long.
7. Stem leaves (1)2-7; leaf tips of basal rosettes 5-30 mm. long; bracts 8-12(-14) mm. long; plants of low desert areas, 1000-5000 feet.....3f. var. *megacephalus*.
7. Stem leaves 0-3; leaf tips of basal rosettes 3-15 mm. long; bracts 6-10 mm. long; plants of higher elevations associated with juniper, oak or pine, 5000-9000 feet.....3g. var. *lugens*.
5. Anthers 2-3 mm. long; corolla 2.5-4.5 mm. long; pappus 0.2-3.0 mm. long; achenes 4-6 mm. long; corolla throat 2-5 times as long as the lobes.
8. Heads 5-60 per stem; stem leaves 3-8; leaf tips of basal rosettes 10-30 mm. long; throat 1.3-1.8 mm. long; plants of the northern Great Plains, E. of the continental divide.....3h. var. *polycephalus*.
8. Heads 1-40 per stem; stem leaves 0-12; leaf tips of basal rosettes 2-50 mm. long; throat 1.5-2.5 mm. long; plants of the Rocky Mts. or W. of continental divide (except for disjunct populations in the panhandle of Texas).
9. Stem leaves 5-12; leaf tips of basal rosettes 3-6 mm. long; endemic to S. W. Utah.....3i. var. *tomentosus*.
9. Stem leaves 0-5; leaf tips of basal rosettes 3-50 mm. long.
10. Pappus 0.2-1.0 mm. long; leaf tips of basal rosettes 15-50 mm. long; plants 30-100 cm. high; heads (2-)6-40 per stem; plants of Oregon and Washington.....3j. var. *filifolius*.
10. Pappus 0.6-3 mm. long; leaf tips of basal rosettes 2-30 mm. long; plants 5-50 cm. high; heads 1-6(-14) per stem; plants elsewhere.
11. Peduncles 3-15 cm. long; achene hairs 0.2-1.0 mm. long; pappus 1.5-3 mm. long; plants of the Great Basin.....3k. var. *nanus*.
11. Peduncles 1-6 cm. long; achene hairs 1-3 mm. long; pappus 0.6-2 mm. long; plants elsewhere.
12. Pappus 0.6-1.3 mm. long; stem leaves 0-2; plants of Idaho.....3l. var. *idahoensis*.
12. Pappus 1.5-2 mm. long; stem leaves (0) 2-4; plants not of Idaho.....3m. var. *cinereus*.

3a. *Hymenopappus filifolius* var. *parvulus* (Greene), comb. nov.

*Hymenopappus parvulus* Greene, Pl. Baker. 3: 30. 1901. Isotype examined (pom): "Gunnison," Colorado, 7680 ft., July 17, 1901. C. F. Baker 449. Isotypic material of Baker 449 is not widely distributed. Only the one sheet was seen by the author. Cotype material, Baker 840, is typical of the variety and is found in several herbaria.

Plants perennial, 10-25 cm. high; stems unbranched, very sparsely grayish-green tomentose to reddish-glabrate; larger rosette leaves sparsely

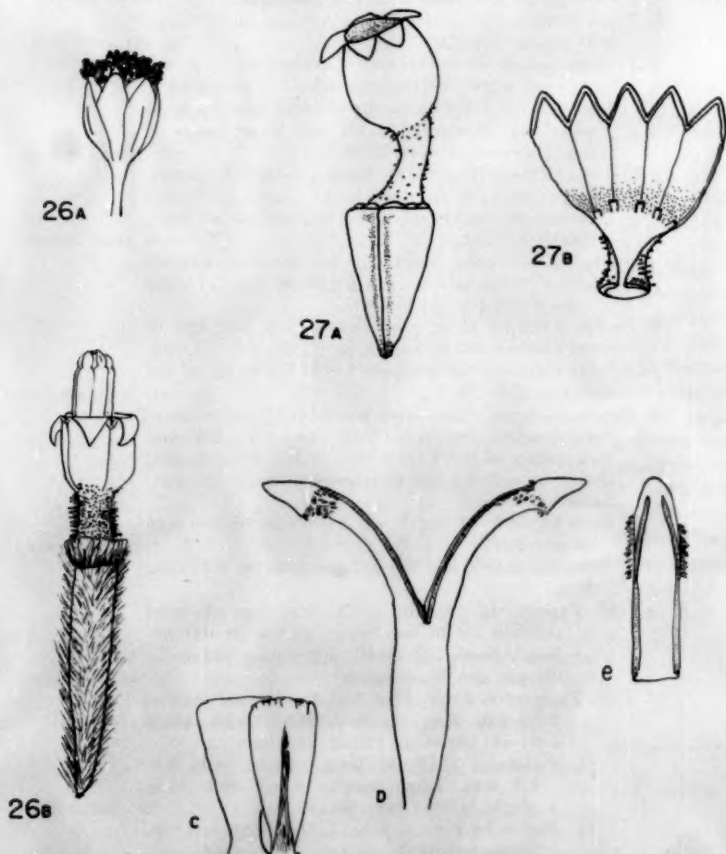


FIG. 26-27. Floral morphology of *Hymenopappus* species. FIG. 26. *H. filifolius* var. *filifolius* (T. 2293): (a) head,  $\times 1.5$ ; (b) floret,  $\times 8$ ; (c) pappus scales,  $\times$  ca. 40; (d) style branches,  $\times$  ca. 45; (e) upper surface of style branch,  $\times$  ca. 45. FIG. 27. *H. mexicanus* (Rusby 179): (a) peripheral floret,  $\times 8$ ; (b) corolla opened, showing equal lobes,  $\times 8$ .



pubescent to glabrate, without a dense tomentum in the axils, 3–10 cm. long, 2–5 cm. wide, typically once-pinnate with a few scattered, linear, secondary divisions, 0.5–1 mm. wide, 5–20 mm. long, petiole conspicuous, composing  $\frac{1}{2}$ – $\frac{2}{3}$  of the leaf; stem leaves 0–2, much reduced; heads 3–10 (rarely–15) per stem, subturbinate, 10–18-flowered, on very short peduncles 5–15 mm. long; principal involucre bracts glabrate to pubescent below, 4–8 mm. long, 2–3 mm. wide, yellow-membranous for 1–2 mm. from the acute tip (very rarely red-tinged); corollas yellow, 2–3 mm. long, tube densely glandular, 1–1.5 mm. long, throat campanulate-tubular, 1.5–1.8 mm. long with lobes reflexed; achenes 3.5–4 mm. long, pubescent with hairs about 1 mm. long; pappus of 14–16 linear oblong scales, 1–1.8 mm. long; anthers partly exerted, about 2 mm. long;  $n = 17$ .

DISTRIBUTION.—Sandy or rocky, gravelly slopes on foot-hills (5500–8600 ft.) in sunny, exposed situations of central and southwestern Colorado (Fig. 28). Late June–August.

*Hymenopappus filifolius* var. *parvulus* is one of the most distinct varieties of the *H. filifolius* group, being distinguished by its congested, small, few-flowered heads and by its almost complete lack of wool in the axils of basal rosette leaves (this latter character is shared only by var. *nudipes* in this complex).

In the garden at Pullman, Washington, all these distinguishing characters appeared again on ten plants grown from seed collected in the field (Preece & Turner 2802), except that there was a tendency toward a more leafy rosette and generally increased size of vegetative organs.

Johnston (1923), included this variety within his *H. filifolius* var. *cinereus* with some reservation, stating, "*Hymenopappus parvulus* is referred here with great doubt, and I am inclined to believe that it probably is specifically distinct as it differs from the variety *filifolius* [sic] in its subscapose habit and small heads."

This variety seems closest, morphologically, to the variety *nudipes* from which it differs in the fewer number, and smaller size of the florets, and its shorter-peduncled, more congested inflorescence.

Though spatially the ranges of var. *parvulus* and var. *cinereus* overlap, the two are kept separate for the most part by altitudinal and topographic differences, *H. filifolius* var. *parvulus* being found usually at lower elevations on bare, sandy or gravelly slopes; var. *cinereus* occurs at somewhat higher elevations in clays and silts, mostly on vegetated valley bottoms and hill-sides. However, the two probably cross readily, and evidence

TABLE 1 ANALYSIS OF DIFFERENCES BETWEEN VARIETIES OF *HYMENOPAPPUS FILIFOLIUS*

| Variety              | Chromosome number n | Corolla color | Bracts red tipped | Corolla length mm. | Throat length mm. | Throat/lobe ratio | Number florets | Heads per stem | Pedicel length cm. |
|----------------------|---------------------|---------------|-------------------|--------------------|-------------------|-------------------|----------------|----------------|--------------------|
| <i>polyccephalus</i> | 34                  | yellow        | -                 | 3.0-3.5            | 1.3-1.8           | 2-3               | 20-50          | 5-60           | 2-6                |
| <i>cinereus</i>      | 17                  | yellow-white  | +                 | 3.0-4.5            | 1.5-2.0           | 2-5               | 25-40          | 1-6            | 1-6                |
| <i>luteus</i>        | 17                  | yellow        | -                 | 2.0-3.0            | 1.0-1.6           | 2-3               | 15-25          | 5-50           | 1-7                |
| <i>pauciflorus</i>   | 17                  | yellow        | -                 | 2.0-3.0            | 1.0-1.6           | 2-3               | 10-30          | 2-15(-30)      | 2-6                |
| <i>tomentosus</i>    | 17                  | yellow        | -                 | 3.0-4.5            | 1.5-2.5           | 3(6)              | 30-40          | 4-14           | 1-6                |
| <i>capitatus</i>     | —                   | yellow        | +                 | 4.0-7.0            | 2.0-3.0           | 3-6               | 25-60          | 3-10           | 2-10               |
| <i>erfopodius</i>    | —                   | white         | +                 | 4.0-5.0            | 2.0-3.0           | 3-5               | 30-60          | 3-8            | 2-16               |
| <i>luteus</i>        | 17                  | yellow        | +                 | 4.0-5.0            | 1.5-2.0           | 3-5               | 30-72          | 3-8            | 2-12               |
| <i>nanus</i>         | 17, 34              | light yellow  | +                 | 3.0-4.5            | 1.5-2.0           | 3-5               | 20-50          | 4-14           | 1-6                |
| <i>idahoensis</i>    | 17                  | yellow        | +                 | 3.5-4.5            | 1.5-2.5           | 3-5               | 20-50          | 4-14           | 1-6                |
| <i>filifolius</i>    | 17                  | yellow        | +                 | 3.5-4.5            | 1.5-2.5           | 3-5               | 15-45          | (2)-6-40       | 1-15               |
| <i>nudipes</i>       | 17                  | yellow        | +                 | 3.0-5.0            | 1.5-2.5           | 2-3               | 10-35          | 1-10           | 2-10               |
| <i>parvulus</i>      | 17                  | yellow        | -                 | 2.0-3.0            | 1.5-1.8           | 2-3               | 10-20          | 3-10           | 0.5-1.5            |

| Variety              | Tomentum in leaf axils | Achene length mm. | Pappus length mm. | Achene hair length mm. | No. stem leaves | Length of leaf apex mm. | Plant height in cm. | Bract length mm. | Anthers mm. |
|----------------------|------------------------|-------------------|-------------------|------------------------|-----------------|-------------------------|---------------------|------------------|-------------|
| <i>polyccephalus</i> | +                      | 4.0-6.0           | 0.6-1.8           | 1.0-2.0                | (2)3-8          | (4)-10-30               | 20-60               | 5-8              | 5-5         |
| <i>cinereus</i>      | +                      | 4.0-6.0           | 1.5-2.0           | 1.0-3.0                | (0-1)2-4        | 2-6(-15)                | 15-40               | 6-9              | 2-3         |
| <i>luteus</i>        | +                      | 4.0-6.0           | 0.1-2.0           | 1.0-2.0                | 0-3             | 1-5                     | 15-20               | 5-7              | 2-3         |
| <i>pauciflorus</i>   | +                      | 3.0-4.5           | 0.5-1.5           | 1.0-2.0                | 4-9             | 3-6                     | 20-35               | 3-6              | 1-6         |
| <i>tomentosus</i>    | +                      | 4.5-6.0           | 0.6-1.8           | 0.5-1.0                | 5-12            | 3-6                     | 30-60               | 7-10             | 2-5         |
| <i>capitatus</i>     | +                      | 5.0-6.0           | 1.5-3.0           | 1.0-2.0                | (1)2-6          | 3-6                     | 30-60               | 8                | 2-5         |
| <i>erfopodius</i>    | +                      | 5.0-6.0           | 1.5-3.0           | 1.0-2.0                | 0-3             | 3-6                     | 30-70               | 7-10             | 2-5         |
| <i>luteus</i>        | +                      | 4.5-6.0           | 1.5-3.0           | 1.0-2.0                | (0-2)3          | 3-6                     | 45-70               | 7-10             | 2-5         |
| <i>nanus</i>         | +                      | 4.5-6.0           | 0.6-1.8           | 0.2-1.2                | 0-2             | 3-6                     | 20-60               | 6-10             | 2-5         |
| <i>idahoensis</i>    | +                      | 4.5-6.0           | 0.6-1.8           | 1.0-2.0                | 0-2             | 3-6                     | 10-45               | 7-10             | 2-5         |
| <i>filifolius</i>    | +                      | 4.5-6.0           | 0.2-1.0           | 0.4-1.0                | (0)2-5          | 15-50                   | 30-100              | 6-10             | 2-5         |
| <i>nudipes</i>       | +                      | 4.5-6.0           | 1.5-2.5           | 0.5-1.2                | 0-1(2)          | 6-40                    | 5-45                | 6-10             | 2-5         |
| <i>parvulus</i>      | -                      | 3.5-4.0           | 0.6-1.8           | 1.0                    | 0-1(2)          | 3-20                    | 10-25               | 4-8              | 2.0         |

of introgression of one into the other may be seen at several places in the field, as well as among herbarium specimens.

REPRESENTATIVE SPECIMENS.—**Colorado.** DOLORES CO.: boundary of Montezuma Nat'l. Forest, T39 N, R14 W, *M. Ownbey* 1475 (ds, GH, MO, NY, RM, UC, WS). GRAND CO.: Sulphur Springs, *J. Wolf* 476 (US). GUNNISON CO.: Gunnison, *C. F. Baker* 840 (ds, GH, MO, NY, POM, RM, UC, US, WS). MINERAL CO.: 4.7 mi. S.W. of Creede, *M. & G. B. Ownbey* 3040 (NY, RSA, SMU, WS). PARK CO.: South Park, 1871, *T. Meehan* (NY). SAGUACHE CO.: hills about Elko, highway 50, *Preece & Turner* 2816 (SMU, WS).

3b. *Hymenopappus filifolius* var. *nudipes* (Maguire), comb. nov.

*Hymenopappus nudipes* Maguire, Am. Midl. Nat. **37**: 143. 1947. Type examined (NY): Utah, Kane Co., 15 mi. N. of Orderville, frequent under yellow pine and manzanita, sandy soil, 5800 ft., June 15, 1940, *B. Maguire* 18740.

*Hymenopappus nudipes* var. *alpestris* Maguire, Am. Midl. Nat. **37**: 144. 1947. Type examined (NY): Utah, Iron Co. Cedar Breaks Rim, 10,400 ft., June 23, 1940, *B. Maguire* 19023.

Plants perennial, 5–30 (–45) cm. high, sparsely tomentose to glabrate, up to 70 crowns from a single tap-root, larger rosette leaves 6–13 cm. long, 3–5 cm. wide, typically once-pinnate or with a few secondary divisions, these flattened and linear, 1–2 mm. wide, petiole frequently reddish-glabrate at base, comprising  $\frac{1}{2}$ – $\frac{3}{4}$  of the leaf, without a dense tomentum in the axil; stem leaves 0 or 1(2), much reduced; heads campanulate, 1–12 per stem, 15–35-flowered, on ultimate peduncles 2–10 cm. long; principal involucre bracts 6–10 mm. long, 2–5 mm. wide, yellow, or commonly reddish-membranous for 1–2 mm. from the obtuse tip; corollas yellow, 3–5 mm. long, tube glandular, 1.5–2.5 mm. long, throat campanulate, 1.5–2.5 mm. long with lobes reflexed; 2–4 times longer than the lobes; achenes 4.5–6 mm. long, pubescent with hairs 0.5–1.2 mm. long; pappus of 14–16 linear-oblong scales, 1.5–2.5 mm. long (rarely less); anthers about one-half exerted 2.5–3 mm. long;  $n = 17$ .

DISTRIBUTION.—Barren, mostly exposed, gravelly, sandy, and sandy-clay soils, principally in Utah along the eastern slopes of the Wasatch Mountains southwestward to Kane Co., 6000–11,500 feet (Fig. 28). June–July.

*Hymenopappus filifolius* var. *nudipes* is probably most closely related to var. *nanus* or var. *parvulus*. It differs from the former in the fewer florets, more glabrate leaves, and lack of a dense tomentum in the rosette leaf axils; it differs from the latter in having larger florets and heads, larger pappus, and a more open, longer-peduncled inflorescence. Thus var. *nudipes* seems to stand intermediate between these two varieties. The same situation exists as concerns their geographical distribution;

var. *parvulus* occurs on the dry barren foothills of central and southwestern Colorado and var. *nanus* occurs to the west on the Great Basin ranges.

The range of var. *nudipes* overlaps that of var. *lugens* in the southwestern part of Utah. Apparently, the two are kept separate, for the most part, by ecological factors; for example, var. *nudipes*, at the type locality, occurs on sandy-clay, barren slopes, in what appear to be "pure" colonies. Not more than one-fourth of a mile distant and at somewhat higher elevations,

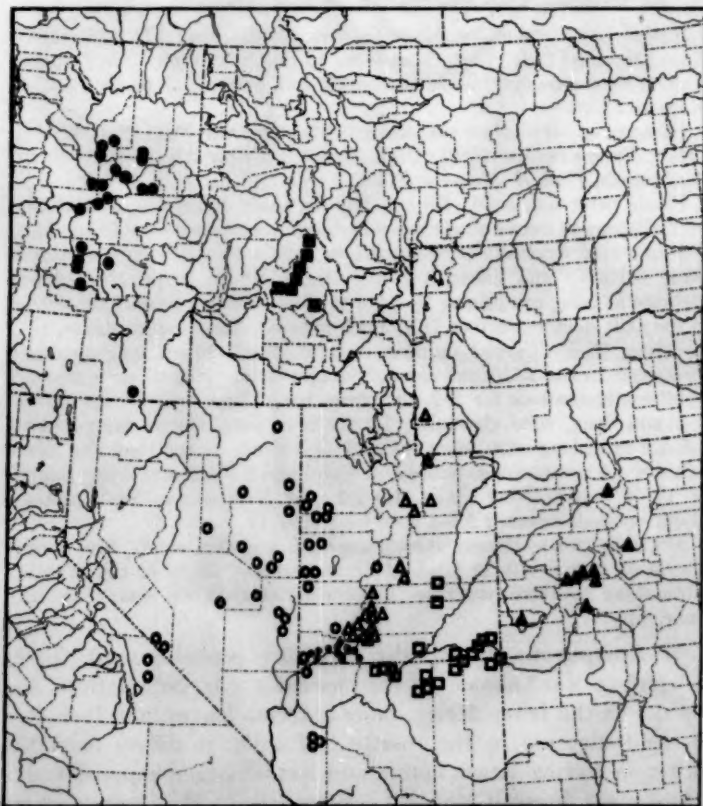


FIG. 28. Distribution of some varieties of *Hymenopappus filifolius*. *H. f. filifolius* (large disks), *H. f. nanus* (circles), *H. f. idahoensis* (squares), *H. f. tomentosus* (small disks), *H. f. nudipes* (open triangles), *H. f. pauciflorus* (open squares), and *H. f. parvulus* (triangles).

a "pure" colony of var. *lugens* may be found growing on a flat mesa top in sandy-gravelly soil. However, evidence of extra-variety contamination or introgression is not completely lacking. Occasional plants, in the field as well as on herbarium sheets, are seen which have considerable amounts of tomentum in the leaf axils (but not so much as var. *lugens*), probably indicating gene-flow or introgression from that variety (*Daly 7-BD*).

At lower elevations in the Bryce Canyon region where *Hymenopappus filifolius* var. *nudipes* comes close to the western-most range of var. *civereus*, nearly complete intergradation of these two varieties occurs (*Goodman & Hitchcock 1599*; *Preece & Turner 2476*).

*Hymenopappus nudipes* var. *alpestris* is considered to be a form of var. *nudipes* which occurs at somewhat higher elevations (10,000–11,500 ft.). It cannot be separated from other material of the variety by any constant, particular characters, though there is a general tendency for a smaller, more pubescent, later-flowering plant to develop at these altitudes. Completely transitional types occur from higher to lower elevations, and comparison of several collections from the type locality of Maguire's "ecotype" shows considerable variability in their characters.

REPRESENTATIVE SPECIMENS.—**Utah.** DUCHESNE CO.: about 18 mi. W. of Duchesne, highway 40, *Ferris 11326* (CAS, DS). GARFIELD CO.: 6 mi. N. of entrance to Bryce Canyon, *Goodman & Hitchcock 1599* (CAS, DS, GH, MO, NY, RM, UC). IRON CO.: 1 mi. E. of Museum in narrow belt along Rim, 10–100 feet wide, Cedar Breaks, *Preece & Turner 2436* (WS). KANE CO.: 15 mi. N. of Orderville, *Maguire 18740* (GH, NY, MO, UC, US, WS). PIUTE CO.: Brigham Peak, Marysvale, Aug. 29, 1894, *M. E. Jones 5958k* (POM, US). SEVIER CO.: Sawtooth, 15 mi. up Salina Canyon *Keck 680* (CAS, GH, POM, UC). SUMMIT CO.: Uintah Mts., Mt. Elizabeth, Cow Hollow, Aug. 12, 1928, *G. J. Goodman 552* (RM). UTAH CO.: Soldier Summit, July 25, 1947, *Holmgren, Boyle, & Ballenger 7055* (UC). **Wyoming.** LINCOLN CO.: Fossil, Aug. 9, 1895, *G. W. Letterman* (MO). (There are two specimens on this sheet representing two taxa, var. *nudipes* and *H. filifolius* var. *polyccephalus*, neither of which has been collected near this locality. It seems more probable that the plant of var. *nudipes* goes with the label since the variety has been collected at Mt. Elizabeth, Utah, only a short distance across the border from southwestern Wyoming.)

### 3c. *Hymenopappus filifolius* var. *luteus* (Nutt.), comb. nov.

*Hymenopappus luteus* Nutt., Trans. Am. Phil. Soc. 7: 374. 1840. Probable isotype examined (GH): "Rocky Mts., Nuttall!" In the type

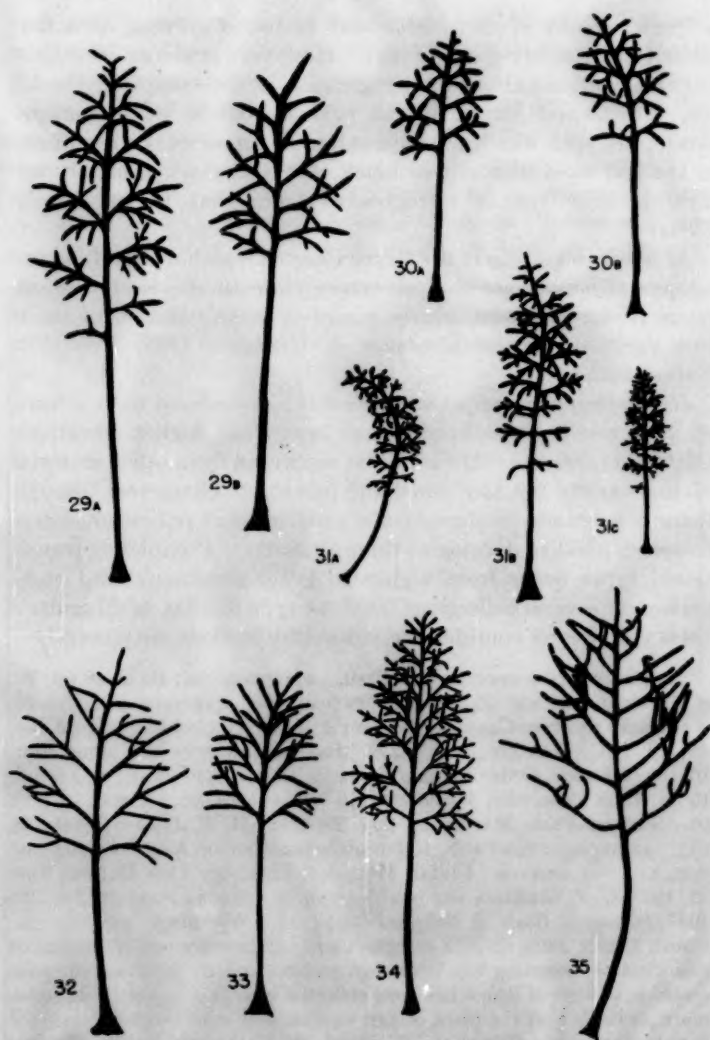


FIG. 29-35. Leaf silhouettes of *Hymenopappus filifolius* varieties. FIG. 29a, b. *H. f. lugens*, yellow-flowered tetraploid race (P. & T. 2614). FIG. 30a, b. Same, yellow-flowered diploid race (P. & T. 2645). FIG. 31a, b, c. *H. f. luteus* (P. & T. 2873). FIG. 32. *H. f. nanus* (P. & T. 2608). FIG. 33. *H. f. parvulus* (P. & T. 2802). FIG. 34. *H. f. cinereus* (P. & T. 2739). FIG. 35. *H. f. idahoensis* (P. & T. 2378). All  $\times$  ca. 1/3.



description Nuttall gave the following locality, "Rocky Mts., towards the Colorado of the west, particularly on Ham's Fork." The type was probably collected in what is now Lincoln Co., Wyoming.

Plants perennial, with slender stems, 10-30(-45) cm. high, densely tomentose to nearly glabrate; rosette leaves 3-6 cm. long, 1-1.5 cm. wide, bipinnately dissected with many very short divisions, 1-3 mm. long (resembling *Achillea*), the petiole composing less than  $\frac{1}{2}$  the leaf length; stem leaves 0-4, commonly 2, becoming reduced upward; heads 5-50 per stem, commonly 10 or more, campanulate, 15-30-flowered, on slender, often reddish, ultimate peduncles 1-7 cm. long; principal involucrel bracts 5-7 mm. long, 2-3 mm. wide, yellow to reddish-membranous for 1-2 mm. from the acute to obtuse tip; corollas yellow, 2-3.5 mm. long, the tube densely glandular, 1-2 mm. long, the throat campanulate, 1.2 mm. long with lobes reflexed, (2-)3-4 times as long as the lobes; achenes 4-5 mm. long, evenly pubescent with hairs 1-2 mm. long; pappus of 14-18 linear oblong scales, 0.1-0.8 mm. long; anthers partially exserted, about 2 mm. long;  $n = 17$ .

DISTRIBUTION.—Gravelly, calcareous or sandy foothills in the basin areas of central and southwestern Wyoming, extending into adjacent Utah (Uinta Basin) and Moffat Co., Colorado (Fig. 36). June-July.

*Hymenopappus filifolius* var. *luteus* is a very distinct, easily recognized variety over a large part of its range; however, the characters of the variety intergrade completely with those of var. *cinereus* in Moffat Co., Colorado, and, to a lesser degree, with the characters of var. *megacephalus* in the Uinta Basin, Utah (E. H. Graham 8300, 9144; Ripley & Barneby 7793).

*Hymenopappus filifolius* var. *luteus* is somewhat variable as to size of vegetative organs and number of heads produced, even within the same race, when habitats differ. Preece & Turner 2872, 2873, 2874 (all at ws) represent specimens that were collected from along a roadside in an old bladed area, from deeper soiled shallow ditch, and from an unbladed adjacent hillslope respectively. It was thought at first that there might be some conspicuous genetic difference between the individuals comprising the three groups since there seemed to be considerable phenotypic variation, this appearing somewhat correlated with the habitats mentioned. Seed was collected from the extreme individuals of the groups (2872, 2873) within the race, and ten plants of each of these groups were grown from seed in a uniform garden. The resulting progeny (20 individuals) were essentially of the same type, being quite uniform in height, number of heads produced, and other features. Meiosis appeared to be normal.

REPRESENTATIVE SPECIMENS.—**Colorado.** MOFFATT CO.: 10 mi. W. of Maybell, *Porter 3608* (DS, GH, RM, UC, US). **Utah.** DAGGETT CO.: 1.5 mi. S. of Manila, *M. Ownbey 3255* (WS). UTAH CO.: N.W. of mouth of Split Mt. Canyon, above Island Park, *Graham 9144* (GH, MO). **Wyoming.** ALBANY CO.: Sheep Cr., Aug. 21, 1899, *C. Schuckert* (?) (NY). BIG HORN CO.: Trapper Cr., *C. Finley 23* (RM). CARBON CO.: Fort Steele, *Nelson 7150* (GH, MO, NY, POM, RM, US). LINCOLN CO.: E. of Opal, *Ripley & Barneby 7864* (CAS). NATRONA CO.: Satanka Fm., near Alcova, *Porter 4485* (GH, RM, RSA). SUBLETTE CO.: 6 mi. E. of Big Piney, *E. B. & L. B. Payson 2594* (GH, MO, NY, POM, RM, UC). SWEETWATER CO.: Granger, *Nelson 4695* (NY, RM, UC, WS). UINTEA CO.: 16 mi. S.E. of Lyman, *Rollins 1674* (DS, GH, MO, NY, UC, US).

3d. *Hymenopappus filifolius* var. *pauciflorus* (Johnston), comb. nov.

*Hymenopappus pauciflorus* Johnston, Contrib. Gray Herb. n.s. 68: 97. 1923. Type examined (GH): Utah. "along San Juan River, near Bluffs," 1200-1500 m., Aug. 25-29, 1911, *P. A. Rydberg & A. O. Garrett 9951* (Isotype NY).

Plants perennial, 20-35 cm. high, tomentose to nearly glabrate, usually the much-branched stems from several crowns, giving a bushy aspect to the whole plant; rosette leaves 5-7 cm. long, 1-2 cm. wide, canescent to loosely tomentose, bipinnately dissected with short, linear divisions 1-5 mm. long, 0.5-1 mm. wide (resembling those of var. *luteus*); stem leaves 3-9, becoming reduced upward; heads 2-15(-30) per stem, sub-turbinate, 10-30-flowered, on ultimate slender peduncles 2-6 cm. long; principal involucre bracts 3-6 mm. long, 2-3 mm. wide, pubescent to nearly glabrate, yellow-membranous for about 1 mm. from the tip; corollas yellow, 2-3 mm. long, the tube densely glandular, 1-2 mm. long, the throat 1-1.6 mm. long with lobes reflexed, 2-3 times longer than the lobes; achenes 3-4.5 mm. long, evenly pubescent with hairs 1-2 mm. long; pappus of 14-18 linear oblong scales, 0.5-1.5 mm. long; arthers partially exserted, 1.6-2 mm. long;  $n = 17$ .

DISTRIBUTION.—Low desert areas in sandy soils of southeastern Utah, adjacent Arizona and the southwestern-most corner of Colorado (San Juan R.), 3800-5500 feet (Fig. 28). May-September.

*Hymenopappus filifolius* var. *pauciflorus* seems to have its closest relationship with varieties *luteus* and *cinereus*. In many respects it stands intermediate between the two. It differs from the former in having higher, more leafy stems with fewer heads, and from the latter in its more numerous heads which contain fewer, smaller florets.

There seems to be considerable intergradation between *H. filifolius* var. *pauciflorus* and var. *cinereus* in the southeastern part of Utah at intermediate elevations where the two taxa

overlap in their ranges (*Standley 7334*); however, they are kept separate, for the most part, by altitudinal barriers. Var. *cinereus* occurs on the mountain ranges, in this area, from 5000–10,000 feet; var. *pauciflorus*, as noted above, occurs at lower altitudes from 3800–5500 feet. In addition, var. *pauciflorus* grades into var. *tomentosus* in southwestern Utah (*S. B. Benson 146*) and locally, in parts of its range, into var. *megacephalus*. The mechanism or method whereby this latter variety retains its distinctiveness in the range of var. *pauciflorus* is not known. Apparently they occur at similar elevations, and evidence of introgression or contamination is seen in several collections (*J. T. Howell 24714*; *M. E. Jones*, May 19, 1914). In spite of the considerable intergradation with adjacent or overlapping varieties, var. *pauciflorus* retains a remarkable degree of uniformity throughout its range, especially in regard to its small florets and leafy stems.

The "*filifolius* complex" in this area obviously needs extensive field study and detailed chromosomal investigation.

REPRESENTATIVE SPECIMENS.—**Arizona.** APACHE CO.: N. end of Carrizo Mts., *Standley 7334* (US). COCONINO CO.: 1.5 mi. below Lee's Ferry, *Culler 3152* (DS, GH, MO, NY, SMU). NAVAJO CO.: Navajo Reservation, *Vorhies 130* (GH, MO, NY, UC). **Colorado.** MONTEZUMA CO.: San Juan Valley, *Brandegee 1268* (MO, NY, UC). **Utah.** EMERY CO.: San Rafael Swell, May 19, 1914, *M. E. Jones* (POM). KANE CO.: Kaiparowitz Plateau, Apr., 1939, *Tompkins* (CAS). SAN JUAN CO.: along San Juan R., near Bluffs, *Rydberg & Garrett 9950* (NY, RM, UC, US). WAYNE CO.: 18 mi S. of Hanks-ville, June 10, 1947, *Stoddart & Cook* (UC).

### 3e. *Hymenopappus filifolius* var. *eriopodus* (Nelson), comb. nov.

*Hymenopappus eriopoda* Nelson, Bot. Gaz. **37**: 274–275. 1904. Type examined (RM): Utah. "Rocky volcanic draws. Diamond Valley," May 19, 1902, *L. N. Goodding 880*.

Plants perennial, 40–80 cm. high, sparsely to densely tomentose below, becoming glabrate above; principal rosette leaves sparsely tomentose to glabrate, 10–20 cm. long, 3–7 cm. wide, bipinnately dissected with mostly filiform, ultimate divisions, 10–20 mm. long, 0.4–1 mm. wide; stem leaves (2) 3–7, mostly glossy green and glabrate; heads 3–8 per stem, subturbinate to campanulate, 30–60-flowered, on slender ultimate peduncles 8–16 cm. long (rarely less); principal involucrel bracts 7–10 mm. long, 2–4 mm. wide, sparsely tomentose to glabrate, yellow-membranous for 1–2 mm. from the acute to obtuse tip (often tinged with red); corollas white (ochroleucous), 4–5 mm. long, the tube densely glandular to nearly glabrate, 1.8–2 mm. long, the throat campanulate 2–3 mm. long, with

lobes reflexed, 3-5 times as long as the lobes; achenes 5.5-6 mm. long, evenly pubescent with hairs 0.5-1.5 mm. long; pappus of 12-16 linear-oblong scales, 1.5-2 mm. long; anthers partially exserted, 3-3.5 mm. long; chromosome number not known.

DISTRIBUTION.—Limestone soils, associated with pines and junipers at high elevations (5,500-10,000 ft.) on isolated mountain ranges of

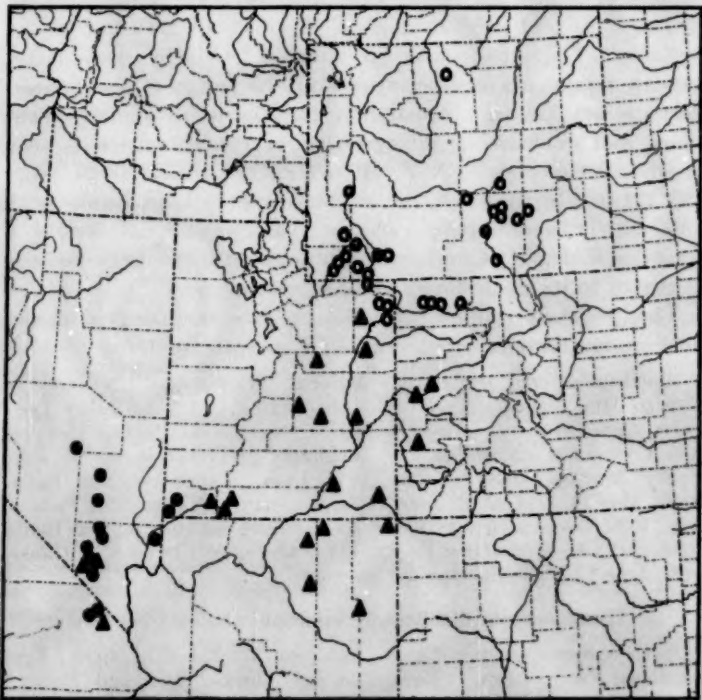


FIG. 36. Distribution of *Hymenopappus filifolius* var. *eriopodus* (disks), *H. f. megacephalus* (triangles), and *H. f. luteus* (circles).

southern Nevada, adjacent California (New York Mts.) and Washington Co., Utah (Fig. 36). Mid-May to mid-July.

*Hymenopappus filifolius* var. *eriopodus* is a very distinct variety in its typical habitat, but at lower elevations it intergrades completely with at least two yellow-flowered taxa of the *H. filifolius* group, var. *megacephalus* and var. *nanus*. Wilson's ranch in the Charleston Mts., Nevada, is outstanding in this

respect. At this locality var. *eriopodus* apparently extends down canyons to lower elevations where it comes in contact with var. *megacephalus*, a variety of the surrounding arid desert (1000-4500 ft.). Within this area of overlap clear  $F_1$ 's or their segregates have been collected (Clokey 8651; Maguire 17992), as well as both the putative parents.

The introgression of var. *eriopodus* with var. *nanus* is less conspicuous, but its effect may be seen by the more leafy stem and pale yellow flowers in the latter variety. This apparent intergradation is conspicuous in the Beaver Dam Mts., Utah, where their ranges overlap (Preece & Turner 2558 cited under var. *nanus*).

*Hymenopappus filifolius* var. *eriopodus* has the vegetative aspect of var. *filifolius* of the Columbia Basin, with which it has frequently been confused. Var. *eriopodus* can be distinguished from var. *filifolius* by its white flowers, and larger size of pappus and throat.

REPRESENTATIVE SPECIMENS.—**California.** SAN BERNARDINO CO.: Clark Mt., 1 mi. S. of Coliseum Mine, Wolf 7069 (DS, RSA, UC, WS). **Nevada.** CLARK CO.: Charleston Mts., Kyle Canyon, Clokey 5618 (CAS, MO, NY, POM, RM, RSA, UC, US, WS). LINCOLN CO.: Deer Lodge, Galway 8265 (US). **NYE CO.:** Nevada Nat'l. Forest, Cherry Cr. Pass, Maguire & Holmgren 25610 (CAS, DS, GH, NY, UC, US, WS). **Utah.** WASHINGTON CO.: Diamond Valley, Goodding 880 (GH, MO, NY, POM, RM, US).

### 3f. *Hymenopappus filifolius* var. *megacephalus*, var. nov.

Herbae perennes, caulibus plerumque tomentosis 1-6-foliatis, 30-60 cm. altis; foliis inferioribus bipinnatis 8-20(-30) cm. longis, segmentis 8-30 mm. longis, 1-2 mm. latis; involucris turbinatis campanulatisve, bracteis 8-12(-14) mm. longis; flosculis flavis 4-7 mm. longis, fauce 2-5 mm. longa; achaeniis 5-7 mm. longis; pappo conspicuo, squamellis 1.5-3 mm. longis.

Plants perennial, 30-70 cm. high, uniformly tomentose or (in the eastern part of its range) nearly glabrate; principal rosette leaves 8-20(-30) cm. long, bipinnately dissected with coarse, flattened, linear divisions, mostly 8-30 mm. long, 1-2 mm. wide; stem leaves 2-6, becoming reduced upwards; heads 3-14 per stem, subturbinate to campanulate, (20-)30-60-flowered, on ultimate peduncles 2-10 cm. long; principal involucre bracts 8-12(-14) mm. long, 2-5 mm. wide, loosely tomentose, yellow to reddish-membranous for 1-2 mm. from the acute to obtuse tip; corollas yellow (apparently pale-yellow in some specimens) 4-6(-7) mm. long, the tube glandular, 2-3 mm. long, the throat campanulate-tubular, 2-4(-5) mm. long with lobes reflexed, 3-6 times longer than the lobes; achenes 5-7

mm. long, pubescent with hairs 1-2 mm. long; pappus of 14-18 linear-oblong scales, 1-3 mm. long; anthers partially exerted, 3-4 mm. long; chromosome number not known. TYPE (POM); Nevada. Clark Co.: Las Vegas, 1000 ft., April 29, 1905, *M. E. Jones s.n.*, (POM, several sheets; DS, MO, US).

DISTRIBUTION.—Sandy or gravelly soil in low desert areas of Clark Co., Nevada, adjacent California (Providence Mts.), eastern and southern Utah, adjacent northeastern Arizona, and western Colorado, 1000-5500 ft. (Fig. 36). May-November.

*Hymenopappus filifolius* var. *megacephalus* is a variety of peculiar distribution and wide variability. In Clark Co., Nevada, at lower elevations it is relatively constant in character, but at higher elevations of adjacent mountain ranges it intergrades with var. *eriopodus* (see discussion under that variety). In eastern Utah, western Colorado, and northern Arizona the taxon is quite variable, possibly as a result of long-time hybridization and multiple introgression with at least five other varieties of the *H. filifolius* complex which surround or overlap its periphery: var. *luteus* in the north; var. *cinereus* in the east; var. *pauciflorus* in the southeast; var. *lugens* in the south; and perhaps locally with var. *tomentosus* in Washington Co., Utah. (For further information see discussion under the appropriate varieties.) In spite of these infringements, the variety maintains a line of continuity which is characteristic over most of its range and for a large part of the material examined. In general the variety has fewer leaves and is less tomentose in the eastern portion of its range as contrasted with its appearance near the type area.

Var. *megacephalus* has apparently been responsible for much of the confusion existing in the *H. filifolius* complex of eastern Utah, northeastern Arizona, and western Colorado. Herbarium material of the variety from this region carried a hodge-podge of annotations: *H. lugens*, *cinereus*, *pauciflorus*, *tomentosus*, *eriopodus*, etc. In Colorado the name *H. ochroleucous* was given by Greene to a local (?) white flowered race of var. *cinereus* (as treated in this paper), which apparently has some of the characteristics of var. *megacephalus* (e.g., larger, coarser-pinnatifid leaves), but much more of the characteristics of var. *cinereus* proper. The type locality for Greene's species is near the eastern-most periphery of the range of var. *megacephalus*.



The possibility exists that the variety here typified includes only the individuals from Clark Co., Nevada, and vicinity, and that most of the remaining material to the east represents either a weakly defined separate variety or a common area of extensive hybridization and introgression among the several peripheral taxa mentioned above, such as that suggested by Gleason (1923) for *Vernonia illinoensis*. Gleason described this species from the Great Lakes region in 1906. Sixteen years later (1922), he decided that what he described as a species was, in reality, a hybrid complex of crosses and backcrosses resulting from the introgression of three species one into the other at a common area of overlap. Accordingly, he dropped the name. In the case of *H. filifolius* var. *megacephalus* the continuity of the combination of characters listed in the description and used in the key, combined with the correlation of supposed introgressant individuals with geographical overlap, argues against this latter hypothesis. In short, the peripheral variability is not random throughout the area of occupation, nor is it meaninglessly scattered. Further field study is needed to clarify the situation fully, but it is believed that the treatment used here is conservative as well as practical.

The variety is named for its large heads which are among the largest of the *Hymenopappus filifolius* complex, equaled or rivaled only by occasional specimens of the closely related var. *lugens*.

**REPRESENTATIVE SPECIMENS.**—**Arizona.** APACHE CO.: National Petrified Forest (Natural Bridge), *Osterhout 6855* (RM). COCONINO CO.: S. side of Painted Desert, *Osterhout 6962* (POM, RM). NAVAJO CO.: Betatakin, *J. T. Howell 24518 and 24519* (CAS). These last two cited specimens present good evidence for hybridization and introgression of var. *lugens* into var. *megacephalus*. **California.** SAN BERNARDINO CO.: Providence Mts., *Brandege* (UC, US). **Colorado.** MESA CO.: DeBegue, *Osterhout 4281* (GH, RM). MONTROSE CO.: Naturita, *Payson 365* (GH, MO, RM, WS). **Nevada.** CLARK CO.: Las Vegas, *Goodding 2287* (GH, MO, RM). **Utah.** CARBON CO.: Price, June, 1898, *Stokes* (UC). EMERY CO.: 3.25 mi. N. of Emery, *M. E. Jones 5456d* (POM). GRAND CO.: Moab, June 9, 1913, *M. E. Jones* (NY, POM). KANE CO.: 1 mi. S. of Zion Junction, *Maguire 18888* (GH, NY, WS). SAN JUAN CO.: 3 mi. S. of White Mesa Dugway, *Holmgren & Hansen 3406* (GH, MO, NY, UC, US, WS). UTAH CO.: Uinta Basin, 4 mi. w. of Willow Cr., E. slope of Big Pack Mts., *Rollins 1709* (GH, MO, NY, WS). WASHINGTON CO.: Zion Nat'l. Park, Summit of Lady Mts., *T. Craig 1433* (POM).

3g. *Hymenopappus filifolius* var. *lugens* (Greene) Jepson

*Hymenopappus lugens* Greene, Pittonia 4: 43. 1899. *Hymenopappus filifolius* var. *lugens*, Jepson, Man. Fl. Calif. 1128. 1926. Lectotype chosen (us): California. San Bernardino Co.: "Bear Valley," San Bernardino Mts., on their eastern base, 6500 ft., June 24, 1894, S. B. Parish 3113. Greene did not designate a specific type, but based his name on two collections of Parish "whose earliest specimens were sent out as representing a variety of *H. luteus*, the later ones being labeled *H. filifolius*." The collection cited above should serve as the type since it is a well-preserved specimen and is represented by isotypes in at least two other herbaria (MO, NY).

*Hymenopappus gloriosus* Heller, Bull. Torr. Bot. Club 26: 551. 1899. Type examined (NY): Arizona. Coconino Co.: "Collected about Mormon Lake," 6000 ft., June 7, 1898, Dr. D. T. MacDougal 71.

*Hymenopappus scaposus* Rydb., Bull. Torr. Bot. Club 27: 634. 1900. Type examined (NY): Arizona. Coconino Co.: "vicinity of Flagstaff," 7000 ft., June 18, 1898, Dr. D. T. MacDougal 1229.

*Hymenopappus macroglottis* Rydb., Bull. Torr. Bot. Club 27: 636. 1900. Type examined (NY): Arizona, Coconino Co.: "Oak Creek, Aug. 5, 1883," N. H. Rusby s.n. The type does not have a collection number, but probable isotypes bear the collection number 692.

*Hymenopappus nudatus* Wooton & Standley, Contrib. U. S. Nat. Herb. 16: 191. 1913. Type examined (us): New Mexico. Grant Co.: Burro Mts., 5500 ft., June 6, 1903, O. B. Metcalfe 107.

Plants perennial, (20-)30-60 cm. high, densely grayish-tomentose to greenish-glabrate, except in the woolly basal leaf axils; rosette leaves (5-)6-14 cm. long, bipinnately dissected with flattened, linear ultimate segments, mostly 3-10 mm. long, 1-3 mm. wide, petiole composing  $\frac{1}{4}$ - $\frac{3}{4}$  of the leaf; stem leaves 0-2(-3), much reduced; heads 3-8 per stem, campanulate, 20-72-flowered, on ultimate peduncles 2-12 cm. long; principal involucre bracts 6-10 mm. long, 3-4 mm. wide, gradate or in two or three main series, glabrous to densely tomentose, the apex conspicuously reddish to yellow-membranous for 1-2 mm. from the mostly obtuse to less often acute tip; corolla bright yellow or less often white, 4-6 mm. long, the tube sparsely glandular, 1.5-2 mm. long, the throat campanulate-tubular 2.2-3 mm. long, with lobes reflexed, (2.2-)4-8 times longer than the lobes; achenes 5-6 mm. long, pubescent with hairs 1-1.5(-2) mm. long; pappus of 16-18 linear-oblong scales, 1.2-2.5 mm. long; anthers partly exserted, 3-3.5 mm. long;  $n = 17, 34$ .

DISTRIBUTION.—Mountain ranges of southern California and northern Baja California; northwestern to southeastern Arizona, adjacent southwestern New Mexico, Nevada (Virgin Mts.), and southwestern Utah, mostly at 5000-9000 ft., commonly associated with junipers, pines, or oaks in gravelly, rocky, clay, volcanic, schistose, and limestone soils (Fig. 37). May-September.

This is the most variable and perplexing variety of the *Hy-*

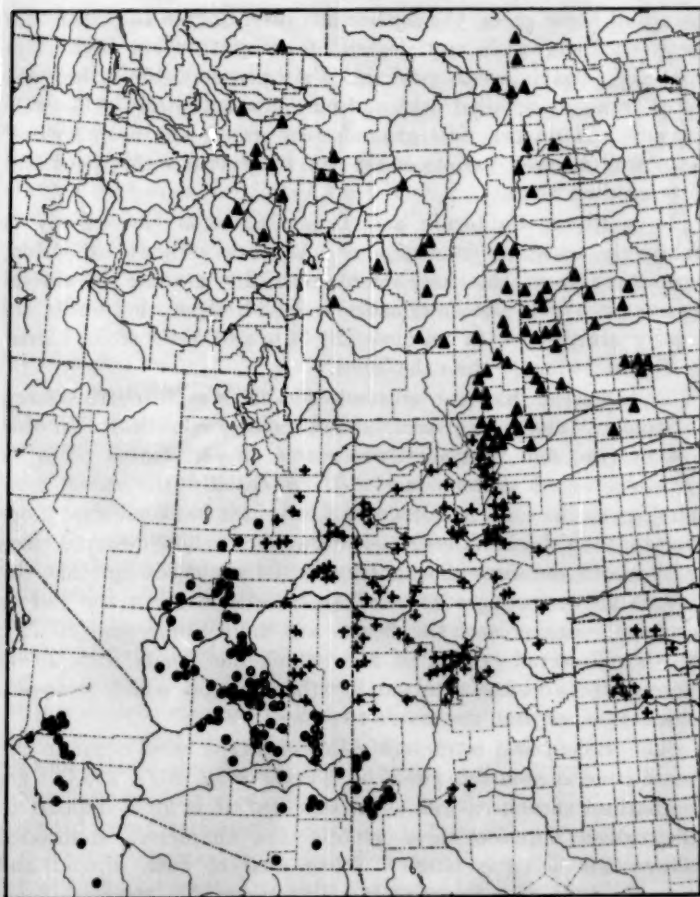


FIG. 37. Distribution of some varieties of *Hymenopappus filifolius*. *H. f. lugens*, yellow-flowered races (disks), white-flowered race (circles); *H. f. cinereus* (plus signs), and *H. f. polycephalus* (triangles).

*menopappus filifolius* complex. The treatment here accorded this variety is admittedly inadequate and future studies will undoubtedly show that the variety, as delimited in the present treatment, is composed of at least two, and possibly three, widespread races that are perhaps worthy of varietal rank. Though

aware of these races, the author has been unable to distinguish between them with any degree of certainty from herbarium material, and it seems probable that proper delimitation will have to await detailed field and chromosomal study. For this reason, and on practical grounds, the group has been treated as a well marked variety composed of several widespread and intergrading races.

In southern California and Baja California the variety is relatively constant in character. Almost without exception, specimens from this area have markedly gradate involueral bracts with red, almost crimson tips and edges; the florets are nearly always few in number (20-30); and the corolla throat is 5-8 times longer than the lobes.

The variety has its greatest complexity in northwestern Arizona (Mohave, Yavapai, and Coconino counties). In this region two, and possibly three, races of var. *lugens* occur: a yellow-flowered diploid race with essentially the same morphology as the California race, except that it has somewhat more florets to a head (20-40); a tetraploid yellow-flowered race with about the same morphology as the above, except that the bracts are not so gradate and are mostly without the red or crimson margins and the florets are more numerous (30-72); a white-flowered tetraploid race which has heads with 20-30 florets, the corollas with smaller throats, and which possesses smaller leaves than the above two races.

The diploid and tetraploid yellow-flowered races occur in the same general area (cf. *Preece & Turner 2610, 2614, 2618*). On herbarium sheets, as well as in the field, it is most difficult to distinguish between these groups, the characters mentioned above not being constant. When seed of both diploid and tetraploid plants were grown in a uniform garden, the tetraploids tended to be larger plants, with larger leaves (Fig. 29) and more numerous florets; diploid plants were smaller, with fewer florets. However, some of the tetraploid plants that were grown in the garden were not so well marked, being small and flowering late with fewer florets (perhaps due to injury during potting). Because of this strong resemblance between diploid and tetraploid races and because the tetraploid race regularly showed 1 to 3 quadrivalents at meiosis, it was suspected early in the

study of this group that the tetraploid arose by autopolyploidy from typical var. *lugens*. However, subsequent investigation revealed the presence of a close relative, var. *nanus* in this region, which apparently introgresses with the diploid race mentioned above. (Var. *nanus* normally lacks the red-tinged involucre bracts, and has more numerous florets with shorter throats than does the diploid form of var. *lugens*.) Thus it now seems more likely that the tetraploid is a segmental amphiploid as defined by Stebbins (1950). Typically, diploid var. *lugens* occurs in this area at higher elevations in pine woods, whereas tetraploid var. *lugens* seems to occur more often in the transition zone of pine woodland and juniper belts, or exclusively in the latter region.

The white-flowered race was not seen by the author west of Flagstaff in this area. It is possible that most, if not all, white-flowered var. *lugens* in Arizona is tetraploid. Unfortunately, most collectors have omitted flower color from their collection labels. The circles on the distribution dot map of var. *lugens* (Fig. 37) indicate those collections examined by the author that were obviously white-flowered (either the color was so indicated on collection labels, or the specimens were well enough preserved to determine this). Field observation indicates that these white-flowered plants are not just segregates in a population of primarily yellow-flowered individuals. In all instances the populations examined by the author were composed entirely of white-flowered individuals, though some populations were intermediate in this respect (i.e., all pale yellow). This white-flowered, tetraploid race loses most of its distinctiveness southward from Coconino Co., Arizona, to Grant Co., New Mexico, as it seems to grade into a densely tomentose,<sup>9</sup> yellow-flowered race with long throats (perhaps the same tetraploid race found in Mohave and Coconino counties).

Var. *lugens* intergrades to a small degree with var. *nudipes* and var. *tomentosus* in southwestern Utah, with var. *cinereus* and var. *megacephalus* in northeastern Arizona, and locally with var. *nanus* in Mohave Co., Arizona, and possibly in the Inyo Mts., California.

<sup>9</sup> The pubescence of these races is probably not a good character on which to distinguish them. Plants grown in the garden from seeds taken from specimens that were quite tomentose in the field appeared nearly glabrate.



In review, *Hymenopappus filifolius* var. *lugens* is a highly variable taxon of the southwestern United States which is composed of two or three closely related widespread races. These races are both diploid and tetraploid and their morphologies are probably complicated by introgression and intergradation from within and from without. In view of the complexities involved, it is believed that formal recognition should not be accorded these infraspecific units until detailed study justifies such action.

REPRESENTATIVE SPECIMENS.—**Arizona.** APACHE CO.: 3 mi. N. of Ft. Defiance, *Culler 2135* (CAS, MO, UC). COCHISE CO.: 5 Mi. E. of Burro Mts., *Maguire 11570* (NY, US). COCONINO CO.: Cape Royal, N. rim of Grand Canyon, *Goodman & Hitchcock 1639* (DS, MO, NY, RM, UC); 9 mi. E. of Peach Springs, *Preece & Turner 2610* (SMU, WS); 2 mi. E. of Ashfork, *Preece & Turner 2618* (SMU, WS); Meteor Crater rim (on boulder near entrance), 38 mi. E. S. E. of Flagstaff, *Preece & Turner 2667* (WS). GILA CO.: Globe, *Nelson 10341* (RM, UC). GRAHAM CO.: 8 mi. up Swift Trail Rd., Pinaleno Mts., *B. & R. R. Maguire 11739* (GH, NY). GREENLEE CO.: 27 mi. N. of Clifton, *Maguire 11073* (NY). MOHAVE CO.: Virgin Mts., pass above Whitney Ranch, *Munz 16783* (MO, POM, WS). NAVAJO CO.: 12 mi. N. of White River, White Mts., *Goodman & Hitchcock 1310* (CAS, DS, GH, MO, NY, RM, UC). PINAL CO.: Oracle, Aug. 27, 1903, *M. E. Jones* (POM). SANTA CRUZ CO.: 2 mi. N. of Vaughn, May 27, 1938, *J. F. Arnold* (CAS, GH, US). YAVAPAI CO.: 5 mi. west of Seligman, *Preece & Turner 2614* (SMU, WS). **California.** RIVERSIDE CO.: El Toro Mts., Coyote Canyon, *H. M. Hall 1178.1* (DS, UC, US). SAN BERNARDINO CO.: near Bear Valley, *Abrams 2899* (CAS, GH, MO, NY, POM, UC, US); San Bernardino Mts., South Fork, upper Santa Ana Canyon, *Hall 7507* (DS, GH, MO, NY, POM, RM, UC, US). SAN DIEGO CO.: between Julian & Cuyamaca ("Gumbo Hill opposite Talley's"), July 16, 1906, *K. Brandegee* (GH, NY, POM, UC, US). **Nevada.** CLARK CO.: "Mica Mines" (Mica Springs), *M. E. Jones 5072g* (US). **New Mexico.** CATRON CO.: 35 mi. N. of Alma, highway 260, June 26, 1951, *Preece & Turner 2710* (SMU, WS). GRANT CO.: Silver City, *Eastwood 8402* (CAS, GH, MO, US); Burro Mts., *O. B. Metcalfe 107* (GH, MO, NY, POM, RM, UC, US). **Utah.** BEAVER CO.: 3 mi. E. of Beaver, May 30, 1913, *H. Redeker* (RM). GARFIELD CO.: 5 mi. S. of Panguitch, *Maguire 18710* (NY, WS). KANE CO.: 3 mi. W. of Long Valley Junction, *Preece & Turner 2466* (SMU, WS). PIUTE CO.: Marysville, *M. E. Jones 5355* (POM, US). SEVIER CO.: near Richfield, *L. F. Ward 168* (GH, MO, US). WASHINGTON CO.: near St. George, *C. C. Parry 107* (GH, MO, NY). **MEXICO. Baja California.** Tantillas Mts., "just over boundary (in Lower California)," Sept. 9, 1875, *E. Palmer 183* (GH, MO, NY, UC, US).



3h. *Hymenopappus filifolius* var. *polycephalus*

(Osterhout), comb. nov.

*Hymenopappus polycephalus* Osterhout, *Torreya* 18: 90. 1918. Type examined (RM): "North of Livermore, Larimer Co., Colo., Aug. 11, 1917," *G. E. Osterhout 5680*.

Plants perennial, 30–60 cm. high, one to several crowns from a single, woody tap-root; stems slender, single from each crown, much-branched, densely tomentose to nearly glabrate, often with conspicuous sessile glands; principal rosette leaves sparsely tomentose to nearly glabrate, 6–15 cm. long, 4–6 cm. wide, bipinnately dissected into linear, almost filiform, glandular-punctate segments 8–30 mm. long and about 0.5 mm. wide; stem leaves 3–8, becoming reduced upwards; heads 5–50 per stalk (often more on late-flowering specimens), 20–50-flowered, on ultimate peduncles 2–8 cm. long; involucre bracts 5–8 mm. long, 2–4 mm. wide, yellow-membranous (very rarely red-tinged) for 1–2 mm. from the acute to obtuse tip; corollas yellow, 3–3.5 mm. long, the tube densely glandular, 1–1.8 mm. long, the throat campanulate, 1.3–1.8 mm. long with lobes reflexed, 2–3 times as long as the lobes; achenes 4–5 mm. long, densely pubescent with hairs 1–2 mm. long; pappus of 12–16 linear-oblong scales, 0.8–2 mm. (rarely less) long; anthers partially exerted, 2.5–2.8 mm. long;  $n = 34$ .

DISTRIBUTION.—Rolling, sandy plains and grasslands east of the Rocky Mountains from central Colorado to Canada (southern Alberta and Saskatchewan), extending on intermontane plains west to north-central Wyoming, western Montana, and east to western North Dakota, South Dakota, and Nebraska (Fig. 37). June–August.

The variety has the aspect of *H. tenuifolius*, especially when poorly collected specimens are dried and placed on herbarium sheets. In the field and on well preserved specimens, the variety can be distinguished at once from this species by the yellow flowers and perennial root. *H. tenuifolius* is a biennial with white flowers.

Osterhout proposed the specific name *polycephalus* in 1918, but it was not taken up by later workers. He apparently was very familiar with the plant in the field, and his numerous collections preserved at the Rocky Mountain Herbarium, with their annotated comments, indicate that he was dissatisfied with placing it either under *H. cinereus* Rydb. or *H. tenuifolius*. Nevertheless, Osterhout thought *polycephalus* was more closely aligned with *H. tenuifolius* since, in describing the species, he stated, "The close relationship of *Hymenopappus polycephalus*, however, is not with *H. cinereus* but with *H. tenuifolius* Pursh. It is as high and as leafy as *H. tenuifolius*, but the flowers are

yellow, not dull white, and it is a perennial, not a biennial." Johnson treated the entity as a questionable synonym of *H. cinereus* stating, "*Hymenoppapus polycephalus* is a puzzling form which suggests a perennial phase of *H. tenuifolius*."

In the present treatment, *polycephalus* has been treated as a variety of *H. filifolius* since its total characteristics indicate a much closer relationship to the members of this species. In spite of this closer affinity, var. *polycephalus* does have several characters which possibly link it to *H. tenuifolius*; indeed, there seems to be a considerable degree of intergradation between the two entities with respect to leaf dissection, amount of tomentum on the stem, and throat/lobe ratio.

It is interesting to note that var. *polycephalus*, so far as known, is tetraploid with  $n = 34$ , while both var. *cinereus* and *H. tenuifolius* are diploid with  $n = 17$ . Var. *polycephalus*, in Colorado, occupies a geographical position between these two taxa. From these facts it might be speculated that at some past time the Rocky Mountain var. *cinereus* came in contact with *H. tenuifolius* so that extensive hybridization occurred on the diploid level and concomitantly amphiploidy occurred. (Evidence of a once farther eastward extension of *H. filifolius* var. *cinereus* is found in the disjunct races of this variety in the panhandle region of Texas, a considerable distance from the normal range now occupied by the variety.) With recession of this peripheral contact at a later time, the amphiploids survived in the habitats in which they were produced and have since spread to the area they now occupy. In the few meiotic slides prepared of var. *polycephalus* pairing appeared normal, there being 34 bivalents. Unfortunately, seed of this variety was germinated too late in the study of this group to provide material for genetical experiments to test this hypothesis.

REPRESENTATIVE SPECIMENS.—CANADA. **Alberta.** Milk R., Macoun 10937 (GH). **Saskatchewan.** Coteau de Missouri (Base of Coteau), Macoun 98 (971) (GH, NY, US).

UNITED STATES. **Colorado.** BOULDER CO.: Lyons, Fritchey 50 (MO). EL PASO CO.: edge of Black Forest, 15 mi. N. of Colorado Springs, Goddard 961 (UC). JEFFERSON CO.: 1 mi. W. of Golden, Beelle 2034 (GH, RM). LARIMER CO.: Fossil Cr., Crandall 3202 (NY, RM, US, WS). MORGAN CO.: Narrows, opposite mouth of Bijou Cr., Ward (US). WELD CO.: near Keota, Osterhout 6035 (RM, UC). **Montana.** BEAVERHEAD CO.: Bannock City, S. Watson 220 (GH, US). BROADWATER CO.: 10 mi. S. E. of Helena, Hitchcock & Muhlick 11782 (WS). CASCADE CO.: Great Falls, Blankinship

721 (MO, POM, RM, US). GALLATIN CO.: St. Joe Cr., 1899, *W. W. Jones* (UC). LEWIS AND CLARK CO.: about 12 mi. N. W. of Silver City, July 2, 1948, *Hitchcock 17917* (RSA, UC, WS). MADISON CO.: about 10 mi. S. W. of Crockett Lake, Gravelly Range, *Hitchcock & Muhlick 12534* (WS). ROOSEVELT CO.: Culbertson, *E. L. Larsen 123* (MO). SILVER BOW CO.: Melrose, *Shear 5023* (NY, US). TETON CO.: Deep Cr. Canyon, Aug. 14, 1899, *Blankinship* (RM). WHEATLAND CO.: 20 mi. S. of Harlowton, *Hitchcock 16314* (RSA, WS). YELLOWSTONE CO.: Custer, June 10, 1890, *Blankinship 145* (MO, UC, US). **Nebraska.** BANNER CO.: Wild Cat Mts., July 16, 1891, *Rydberg* (NY, US). CHASE CO.: S. E. of Enders in Frenchman Valley, *Tolstead 411427* (UC). CHERRY CO.: Merriman, July 11, 1899, *J. M. Bates* (RM). DAWES CO.: Dunlap, June 16, 1939, *H. Hapeman* (MO). HOOKER CO.: Middle Loup R., near Mullen, *Rydberg 1554* (US). LINCOLN CO.: (w/o locality) *Barker 2600* (MO). MORRILL CO.: Broadwater, June 11, 1935, *H. Hapeman* (MO, NY). SCOTTS BLUFF CO.: N. of Mitchell, *Osterhout 7208* (RM). SIOUX CO.: Rocky outcrops, *J. Kramer 7* (DS, MO). THOMAS CO.: Halsey, June 26, 1912, *R. J. Pool & D. Folsom* (MO). **North Dakota.** DIVIDE CO.: Alkabo, *E. L. Larsen 95* (GH, MO). BILLINGS CO.: Medora, *Bolley 402* (NY, RM). HETTINGER CO.: Mott, *O. A. Stevens 143* (UC, US). SLOPE CO.: Marimarth, *L. R. Moyer 480* (NY). STARK CO.: Dickinson, *O. A. Stevens 713* (MO, UC, US). WILLIAMS CO.: Williston, *W. B. Bell 246* (RM, UC). **South Dakota.** CUSTER CO.: Fairburn, *Hayward 1498* (RM). FALL RIVER CO.: 3 mi. S. of Hot Springs, *P. Johnson 229* (GH, NY). HARDING CO.: Table Mt., Cave Hills, *Visher 408* (RM). PENNINGTON CO.: near Wall, *E. J. Palmer 37252* (GH). TODD CO.: Rose Bud Cr., *E. J. Wallace 102* (NY). WASHABAUGH CO.: Bear Cr., *Visher 2085* (NY). **Wyoming.** ALBANY CO.: Sybille Hills (Cr.), *A. Nelson 328* (GH, MO, NY, RM, US). BIG HORN CO.: Otto, Aug., 1878, *N. Edwards* (NY). CONVERSE CO.: E. of Douglas, *C. L. Turner 92* (RM). CROOK CO.: Ewing, *S. Seig 7* (RM). FREMONT CO.: 13 mi. S. of Dubois, *Porter & Rollins 5773* (RM). GOSHEN CO.: Ft. Laramie, *A. Nelson 8310* (GH, MO, NY, POM, RM, US). JOHNSON CO.: near Kaycee, *A. & R. Nelson 1101* (GH, MO, NY, RM, UC, US, WS). LARAMIE CO.: Table Mt., *A. Nelson 1369* (RM). NATRONA CO.: Bates Cr., *L. N. Goodding 199* (DS, POM, RM, UC). NIOBRARA CO.: Lusk, *F. H. Knowlton 106* (US). PLATTE CO.: Guernsey Lake St. Park, *C. L. Porter 4000* (GH, RM, SMU, UC). SHERIDAN CO.: E. of Sheridan, *S. S. Sharp 156* (RM). WESTON CO.: near Newcastle, *Degener & Peiler 16235* (MO, NY).

3i. *Hymenopappus filifolius* var. *tomentosus* (Rydb.), comb. nov.

*Hymenopappus tomentosus* Rydb. Bull. Torr. Bot. Club 27: 633. 1900. Type examined (NY): Utah. "St. George," 1877, *Dr. E. Palmer 270*. *Hymenopappus niveus* Rydb. N. Am. Flora 34: 52. 1914. Type examined (NY): Utah. "Springdale," 4000 feet, May 14, 1894, *M. E. Jones 5261*.

Plants perennial, 30-70 cm. high, permanently densely white tomentose; larger rosette leaves 6-10 cm. long, 2-3 cm. wide, bipinnately parted with many short, filiform divisions 3-6 mm. long; stem leaves 5-12, not much

reduced; heads 4-14 per stem, subturbinate to campanulate, 30-40-flowered, on ultimate peduncles 1-6 cm. long; principal involucre bracts 7-10 mm. long, 2-3 mm. wide, densely tomentose, yellow-membranous for 1-2 mm. from the acute tip (rarely red-tinged); corollas yellow, 3-4.5 mm. long, the tube densely glandular, 1.5-2 mm. long, the throat 1.5-2 mm. long with lobes reflexed, 3-4(-6) times longer than the lobes; achenes 4.5-5 mm. long, evenly pubescent with hairs 0.5-1 mm. long; pappus of 14-16 linear oblong scales 0.8-1.8 mm. long; anthers partially exerted, 2.5-3 mm. long;  $n = 17$ .

DISTRIBUTION.—Sandy soil on rocky limestone hills and mesa tops, 3500-7000 ft.; known only from collections in Washington and western Kane counties, Utah (Fig. 28). May-June.

*Hymenopappus filifolius* var. *tomentosus* occupies a position seemingly at the center of the *H. filifolius* complex as concerns maximum variability and total number of taxa present.

In spite of its restricted range, the variety, as viewed from herbarium and field observation, shows evidence of intergradation or introgression with at least three taxa of the *H. filifolius* complex: var. *pauciflorus*, var. *megacephalus*, and var. *lugens*. These varieties are kept separate for the most part by ecological and/or geographic barriers: var. *lugens* occurs at somewhat higher elevations on gravelly or sandy-clay soils; var. *megacephalus* occurs at lower elevations on sandy soils; var. *pauciflorus* occurs toward the southwestern periphery of the range of *tomentosus* on deep sandy soils. In this latter area almost complete intergradation between the two taxa is found.

At one locality in Kane Co. (1 mi. S. of Glendale, Preece & Turner 2503) a few specimens, apparently intermediate between var. *tomentosus* and var. *lugens*, were found growing in what otherwise appeared to be a "pure" colony of this latter variety. These few intermediates were still in bud so that they lagged at least 1-2 weeks behind the others which were in full bloom. The intermediates collected were of good size (apparently 2-3 years plus in age). Ten plants grown in a uniform garden from seed of var. *lugens* from this locality maintained the characteristics of that variety, and no evidence of contamination from var. *tomentosus* was found. Seed (or open flowers) from the intermediates could not be obtained. Extensive intergradation of characters between varieties *lugens* and *tomentosus* apparently does not occur, though the varieties are probably fully compatible. Further field and genetical studies of the *Hymenopappus filifolius* complex in this area will undoubtedly

yield much information as to isolation mechanisms within several, spatially overlapping, closely related infraspecific taxa.

Variety *tomentosus* has the flower size and shape of var. *mega-cephalus*, but the vegetative characteristics are those of var. *pauciflorus*. Its rather complete intergradation with these two taxa to the southeast and southwest makes the hypothesis that var. *tomentosus* had its origin from an early time of more extensive overlap and introgression attractive, although it is probable that the situation is much more complex than that visualized.

*Hymenopappus niveus* Rydb. is a name based upon specimens which show some evidence of introgression from var. *mega-cephalus* (e.g., leaves somewhat more coarsely pinnatifid); otherwise it is typical of the variety *tomentosus* as here delimited.

REPRESENTATIVE SPECIMENS.—**Utah.** KANE CO.: 1 mi. S. of Glendale, highway 89, *Preece & Turner 2503* (ws). WASHINGTON CO.: near Canaan Ranch, *M. E. Jones 5262C* (MO, POM, UC); St. George, 1877, *E. Palmer 270* (GH, MO, NY, UC).

### 3j. *Hymenopappus filifolius* Hook. var. *filifolius*

*Hymenopappus filifolius* Hook. Fl. Bor. Am. 1: 317. 1833. Probable isotype and fragment of type examined (GH): "on the undulating grounds of the Columbia, near the Wallawallah" *Douglas* (quoted from information given in the original description).

*Hymenopappus tenuifolius* Dougl. (non Pursh) in Fl. Bor. Am. 1: 317. 1833, as synonym.

*Hymenopappus columbianus* Rydb. N. Amer. Fl. 34: 52. 1914. Type examined (us): Washington. "near Moses Lake, Douglas Co." (now Grant Co.), 390 meters, July 4, 1893, *J. H. Sandberg & J. B. Leiber* 375.

Plants perennial, 30–100 cm. tall, densely white tomentose to nearly glabrate; principal rosette leaves 10–20 cm. long, bipinnately dissected with long filiform divisions, 10–50 mm. long, 0.5–1.5 mm. wide; stem leaves (0)–2–5, becoming reduced upward; heads (2)–6–40 per stem, campanulate, (15)–20–45-flowered, on ultimate peduncles 1–15 cm. long; principal involucre bracts 6–10 mm. long, 3–4 mm. wide, densely tomentose to nearly glabrate, yellow-membranous for 1–2 mm. from the acute to obtuse tip; corollas yellow, 2.5–4.5 mm. long, the tube densely glandular, 1.2–2 mm. long, the throat 1.6–2.5 mm. long, 3–5 times longer than the lobes, with lobes reflexed; achenes 4.5–6 mm. long, evenly pubescent with short hairs, 0.4–1 mm. long; pappus of 16–22 linear-oblong scales, 0.2–1 mm. long; anthers partially exerted, 2.5–3 mm. long;  $n = 17$ .

DISTRIBUTION.—Sand dunes and gravelly, sandy soils of the Columbia Basin of Washington and barren sandy-clay or clay soils of adjacent Oregon (John Day Valley, south to Harney Co., Fig. 28). May–September.

*Hymenopappus columbianus* Rydb. is a leafy, densely tomentose form



of the variety. This is the common aspect of the plant in Washington; southward into Oregon both tomentose and glabrate forms occur, as well as leafy and non-leafy types. In the southern part of its range the taxon picks up characters of var. *nanus*, a variety of the Great Basin. However, var. *filifolius* is held together by a combination of characters, the most constant being the small pappus and shortly pubescent achene.

Variety *filifolius* closely resembles var. *polycephalus* of the northern Great Plains, with which it has been confused in nearly all manuals. Variety *polycephalus* is a tetraploid with smaller throats to the corollas, less wool in the leaf axils, and shorter peduncles.

REPRESENTATIVE SPECIMENS.—**Oregon.** CROOK CO.: sandy, sterile hills on the Burns-Prineville road, *Cusick 2631* (GH, MO, NY, POM, RM, UC, US). GILLIAM CO.: hills S. of Arlington, *Henderson 14472* (UC). GRANT CO.: Squaw Cr., Humphrey's Ranch, John Day Valley, *Henderson 5236* (CAS, DS, GH, MO, RM, US). HARNEY CO.: lower Willow Cr. Canyon, *Peck 18990* (UC). MORROW CO.: Paterson Ferry, *Eastwood & Howell 3517* (CAS). WASCO CO.: Muddy or Muddy Station (Muddy Ranch?), John Day Valley, May 12, 1885, *T. Howell 447* (GH, NY, US, WS). WHEELER CO.: 5 mi. N. of Mitchell, *Peck 10081* (NY, WS). **Washington.** ADAMS CO.: 12 mi. W. N. W. of Washtucna, *Turner 2293* (SMU, WS). BENTON CO.: 5 mi. N. W. of Richland, *L. S. Rose 48154* (CAS, RSA, US). FRANKLIN CO.: 8 mi. N. of Kahlotus, *Constance & McMurray 1139* (GH, MO, US). GRANT CO.: near Moses Lake, *Sandberg & Leiberg 375* (CAS, GH, MO, NY, POM, RM, UC, US, WS). WALLA WALLA CO.: near Walla Walla, *Brandegee 903* (GH, UC). YAKIMA CO.: 3 mi. W. of Mabton, highway 3A, June 15, 1950, *R. E. Fye 29* (WS).

### 3k. *Hymenopappus filifolius* var. *nanus* (Rydb.), comb. nov.

*Hymenopappus nanus* Rydb. N. Amer. Fl. **34**: 53. 1914. Type examined (NY): Nevada. Elko Co.: "ridge above Cave Creek Post Office," East Humboldt or Ruby Mts., 9300 ft., Aug. 20, 1908, A. A. Heller 9494.

Plants perennial, 5-50 cm. high, evenly sparsely tomentose throughout or less so on the peduncles; principal rosette leaves 2-12 cm. long, 1-4 cm. wide, bipinnately dissected with linear, nearly filiform, ultimate divisions 5-15 mm. long, 0.5-1.0(-1.5) mm. wide, the secondary divisions few in number, the petiole comprising  $\frac{1}{2}$ - $\frac{3}{4}$  of the leaf; stem leaves 0-2(3), much reduced; heads 1-5(-6) per stem, 30-60-flowered, mostly on long slender peduncles 3-15 cm. long; principal involucre bracts 6-9 mm. long, 2-5 mm. wide, tomentose to nearly glabrate, yellow-membranous (often reddish-tinged) for 1-2 mm. from the acute to broadly ovate tip; corollas light yellow, 3-4 mm. long, the tube moderately glandular, 1.5-2 mm. long, the throat campanulate, 1.5-2 mm. long with lobes reflexed, 2-4 times longer than the lobes; achenes 4.5-5.5 mm. long, pubescent with hairs 0.2-1(-2) mm. long; pappus of 14-18 linear oblong scales, (1-)1.5-3 mm. long; anthers partly exserted, 2.5-3 mm. long;  $n=17$ .

DISTRIBUTION.—Mountain ranges and foothills of the Great Basin, mostly in coarse limestone soils of juniper belts or at higher elevations



on rocky limestone and shaley outcrops, 4800-9800 ft., eastern California (Inyo Mts.) central and eastern Nevada to western Utah and Mohave Co., Arizona (Fig. 28). May-July.

Rydberg assigned the specific name *nanus* to this variety because of its small habit. In the original description he stated, "stems 1 dm., rarely 1.5 dm. high," which is correct for the few specimens he examined; however, isotypic material (mo) shows specimens up to 20 cm. high. An attempt was made to distinguish a group of specimens that would "fit" Rydberg's description. Two groups of plants were sorted out of herbarium material: plants of smaller habit, smaller leaves and fewer heads, and plants of the opposite nature, otherwise essentially alike. When the completed distribution dot-maps were compared there was almost complete overlap of ranges. In addition, complete intergradation of habit, leaf size, and head number was encountered. In short, the variety appears to have a wide ecologic amplitude: where it grows at higher altitudes on rocky outcrops there is a tendency to dwarfness; in more favorable habitats there is a tendency toward robustness.

Variety *nanus* shows some of the characteristics of the typical var. *lugens* in the Inyo Mts., California (*Hovanitz s.n.*), the bracts, in particular, appearing much like this latter variety. The collections from Mohave Co., Arizona (cited below) appear to be established races that apparently have hybridized with var. *lugens*, since they show certain characteristics of that variety. Seed of var. *nanus* collected near Peach Springs (*Preece & Turner 2608*) were grown in a uniform garden along with collections of var. *lugens* from the same general region (*P. & T. 2610*).<sup>10</sup> The contrast between these taxa was maintained (cf., Table 1). In addition, it was noted that the race of var. *nanus* did not produce flowers after mid-August, while var. *lugens* continued to produce flowers until frost set in (late September). A tabulation of the flowering dates of var. *nanus* taken from 37 herbarium sheets representing different collections was made and the following data obtained:<sup>11</sup>

<sup>10</sup> Ten plants were grown of each of these varieties.

<sup>11</sup> The method used in assigning the dates in this chart was as follows: The letter E was given to those specimens in early flower, M for those in mid-flower, and L for those in late flower. After this initial tabulation the L's and E's were moved back and up one week respectively, to approximate more closely equivalent flowering conditions.

| Month | Week | Specimens<br>in flower | Month     | Week | Specimens<br>in flower |
|-------|------|------------------------|-----------|------|------------------------|
| May   | 1    | 1                      | July      | 1    | 5                      |
|       | 2    | 0                      |           | 2    | 2                      |
|       | 3    | 1                      |           | 3    | 1                      |
|       | 4    | 2                      |           | 4    | 0                      |
| June  | 1    | 9                      | August    |      | 0                      |
|       | 2    | 1                      |           |      |                        |
|       | 3    | 11                     |           |      |                        |
|       | 4    | 4                      |           |      |                        |
|       |      |                        | September | 1    | 1                      |

In addition to that with var. *lugens*, var. *nanus* apparently shows some intergradation with var. *eriopodus* at mid-elevations in the mountainous regions, where their ranges overlap (Preece & Turner 2558).

The variety probably has its closest relationships with var. *lugens* and var. *idahoensis*. It can be distinguished from the former variety by its lighter yellow, more numerous florets with shorter throats, more linear, filiform leaf segments, and less crimson-tinged bracts. It may be distinguished from var. *idahoensis*, along with other characters, by its narrower, more pubescent leaf segments, and larger pappus scales.

REPRESENTATIVE SPECIMENS.—**Arizona.** MOHAVE CO.: Hackberry, M. E. Jones 4556 (CAS, DS, NY, POM, RM, UC, US); 6 mi. E. of Peach Springs, Preece & Turner 2608 (SMU, WS). **California.** INYO CO.: Chris's Cabin Flat, Inyo Mts., Alexander & Kellogg 2536 (GH, MO, UC). **Nevada.** ELKO CO.: Ruby Mts., ridge above Cave Creek Post Office, Heller 9494 (MO, NY, UC, US). ESMERALDA CO.: 2 mi. W. of Lida, Silver Peak Range, Maguire & Holmgren 25616 (CAS, DS, GH, MO, NY, UC, US, WS). EUREKA CO.: Monitor Valley, S. of Lone Mt., June 12, 1944, Ripley & Barneby 6221 (CAS). LINCOLN CO.: Pioche, Aug. 31, 1912, M. E. Jones (POM). NYE CO.: near Sunnyside, Ripley & Barneby 4007 (CAS). WHITE PINE CO.: 30 mi. S. of Ely, Maguire & Holmgren 25627 (CAS, DS, GH, NY, UC, US, WS). **Utah.** BEAVER CO.: Half-way station W. of Wa Wa, June 26, 1906, M. E. Jones (POM). IRON CO.: 0.5 mi. S. E. of Cedar City, Degener 16618 (MO, US). JUAB CO.: Fish Springs, June 4, 1891, M. E. Jones (POM). MILLARD CO.: 37 mi. from Delta, Maguire & Becraft 2864 (GH, UC). SEVIER CO.: "Vermilion," W. side of valley, June 4, 1901, M. E. Jones (POM). TOOELE CO.: Dugway, June 2, 1891, M. E. Jones (MO, UC, US). WASHINGTON CO.: 7 mi. S. W. of Shivwits, Beaver Dam Mts., Preece & Turner 2558 (SMU, WS).

(To be continued)

Vol. 58, no. 691, including pages 163-198, was issued 6 August, 1956.

# RATES FOR SPECIAL NUMBERS OF RHODORA

Many of the single numbers can be supplied only at special prices, as follows:

|   |   |                                       |
|---|---|---------------------------------------|
| Vol. 12, no. 134: 50c<br>no. 138: 45c                 | Vol. 37, no. 444: 55c                                 | Vol. 47, no. 557: 75c<br>no. 558: 50c |
| Vol. 13, no. 151: 70c                                 | Vol. 38, no. 445: 40c<br>no. 448: 70c                 | no. 559: 75c<br>no. 560: 60c          |
| Vol. 14, no. 163: 60c                                 | no. 450: 70c  | no. 562: 85c<br>no. 563: 85c          |
| Vol. 15, no. 171: 45c                                 | no. 455: 55c  |                                       |
| Vol. 16, no. 182: 45c                                 | no. 456: 50c  | Vol. 48, no. 566: 60c<br>no. 567: 50c |
| Vol. 17, no. 193: 45c                                 | Vol. 39, no. 458: 50c<br>no. 463: 55c                 | no. 568: 60c<br>no. 569: 50c          |
| Vol. 18, no. 205: 50c                                 | no. 464: 75c  | no. 570: 50c<br>no. 571: 60c          |
| Vol. 19, no. 224: 45c<br>no. 225: 50c                 | no. 466: 55c  | no. 572: 50c<br>no. 573: 70c          |
| Vol. 21, no. 241: 45c<br>no. 243: 45c                 | Vol. 40, no. 471: \$1<br>no. 476: 50c                 | no. 574: 70c<br>no. 575: 70c          |
| Vol. 23, no. 265: 45c<br>no. 268: 45c                 | no. 477: 55c<br>no. 478: 60c                          | no. 576: 50c                          |
| no. 269: 45c<br>no. 270: 45c                          | no. 479: 55c  | Vol. 49, no. 577: 50c<br>no. 578: 60c |
| no. 271: 45c<br>no. 274: 45c                          | Vol. 41, no. 482: 55c<br>no. 486: 55c                 | no. 580: 60c<br>no. 581: 70c          |
| no. 275: 45c  | no. 487: \$1<br>no. 488: 60c                          | no. 582: 80c<br>no. 583: 75c          |
| Vol. 24, no. 279: 45c<br>no. 283: 45c                 | no. 489: 95c<br>no. 490: 50c                          | no. 587: 50c<br>no. 588: 50c          |
| Vol. 25, no. 296: 45c                                 | no. 491: 50c  | Vol. 50, no. 589: 45c<br>no. 590: 60c |
| Vol. 26, no. 304: 50c<br>no. 305: 60c<br>no. 306: 45c | Vol. 42, no. 499: 50c<br>no. 500: \$1<br>no. 502: 50c | no. 591: 40c<br>no. 592: 60c          |
| Vol. 28, no. 331: 45c                                 | no. 503: 70c  | no. 593: 60c<br>no. 594: 40c          |
| Vol. 29, no. 346: 45c                                 | Vol. 43, no. 506: \$1<br>no. 509: \$1                 | no. 595: 75c<br>no. 596: 85c          |
| Vol. 30, no. 351: 50c<br>no. 356: 45c                 | no. 512: 50c<br>no. 513: 50c                          | no. 597: 55c<br>no. 598: 60c          |
| no. 357: 45c  | no. 514: 70c<br>no. 515: 75c                          | no. 599: 60c<br>no. 600: 65c          |
| Vol. 31, no. 364: 50c<br>no. 369: 50c<br>no. 370: 50c | Vol. 44, no. 520: 70c<br>no. 525: 75c                 | Vol. 51, no. 603: 80c<br>no. 604: 85c |
| Vol. 32, no. 374: \$1<br>no. 376: 45c<br>no. 382: 50c | no. 526: 75c<br>no. 527: 70c<br>no. 528: 60c          | no. 609: 75c<br>no. 610: 70c          |
| no. 383: 45c  | Vol. 45, no. 529: \$1<br>no. 531: 60c                 | no. 611: 70c<br>no. 612: 70c          |
| Vol. 33, no. 386: 60c<br>no. 388: 45c                 | no. 532: 55c<br>no. 533: 55c                          | Vol. 52, no. 616: 50c<br>no. 617: 70c |
| no. 389: 45c<br>no. 391: \$1                          | no. 534: 75c<br>no. 535: 70c                          | no. 618: 60c<br>no. 623: 50c          |
| Vol. 34, no. 403: 45c<br>no. 407: 45c                 | no. 538: 85c<br>no. 539: 75c                          | no. 624: 60c                          |
| Vol. 35, no. 410: 50c<br>no. 418: 50c<br>no. 419: 50c | no. 540: 75c  | Vol. 53, no. 625: 60c<br>no. 626: 60c |
| Vol. 36, no. 425: 55c<br>no. 426: 50c                 | Vol. 46, no. 542: 50c<br>no. 544: 60c                 | no. 627: 50c<br>no. 630: 50c          |
| no. 429: 70c<br>no. 430: 55c                          | no. 545: 55c<br>no. 546: 55c                          | no. 635: 50c<br>no. 636: 60c          |
| Vol. 37, no. 433: \$1<br>no. 435: 60c                 | no. 547: 50c<br>no. 548: 45c                          | Vol. 54, no. 637: 50c<br>no. 638: 50c |
| no. 436: 70c<br>no. 437: 50c                          | no. 550: 55c<br>no. 551: 55c                          | no. 639: 50c<br>no. 640: 65c          |
| no. 439: 60c<br>no. 440: 60c                          | no. 552: 50c  | no. 647: 60c<br>no. 648: 50c          |
| no. 441: 50c<br>no. 443: 55c                          | Vol. 47, no. 553: 75c<br>no. 554: 50c                 |                                       |
|   | no. 555: 60c<br>no. 556: 75c                          |                                       |

## DUPLICATE BOOKS FOR SALE

These books have Library book plates and are used copies, some worn, some in need of binding.

ALLIONI, C. Flora Pedemontana . . . Augustae Taurinorum, 1785. 3 volumes in 2. 92 plates. folio. \$50.00

BOOTT, FRANCIS. Illustrations of the genus Carex. London, 1858-67. 4 volumes. 600 plates. folio. 60.00

JACQUIN, N. J. Observationum botanicarum . . . Pars I-IV. Vienna, 1764-71. 100 plates. folio. 80.00

LA BILLARDIERE, J. J. H. DE. Novae Hollandiae plantarum specimen. Paris, 1804-06. 2 volumes. 265 plates. quarto. 75.00

ROYLE, J. F. Illustrations of the botany and other branches of the natural history of the Himalayan Mountains . . . London, 1839-40. 2 volumes. 78 plates. folio. 80.00



ADDRESS THE LIBRARIAN

GRAY HERBARIUM OF HARVARD UNIVERSITY  
22 Divinity Avenue, Cambridge 38, Mass.